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# AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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## Some Leading Articles in this Number.

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A Novel French Milling Machine.
Methods of Assembling Bicycle Wheels.
Manufactures in Japan.
Making a Great Dynamo.
Action of Shunt and Compound-Wound Dynamos.
The Business Side of Special Fixtures.
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NINETEENTH YEAR.

No. 28.
July 9,
1896.

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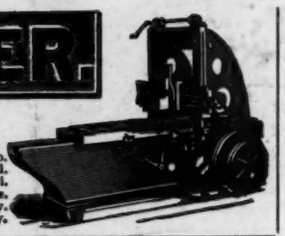

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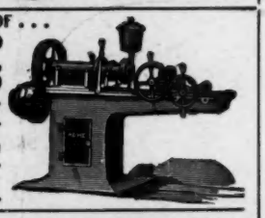

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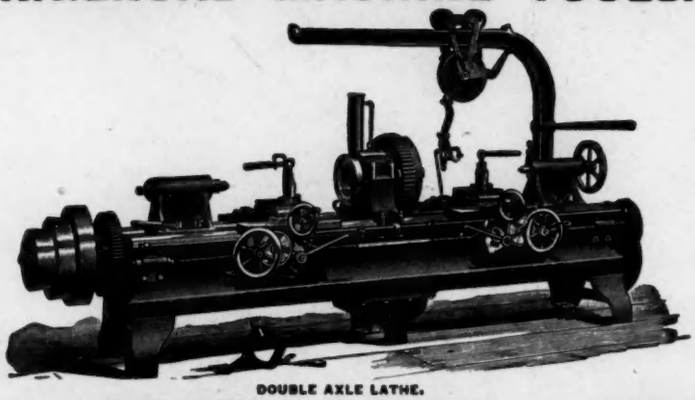

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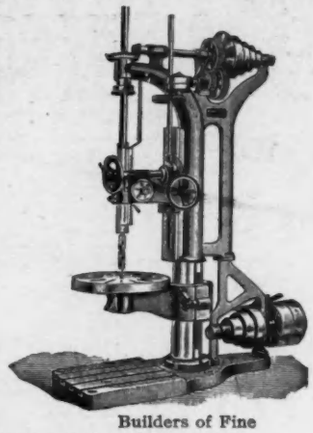

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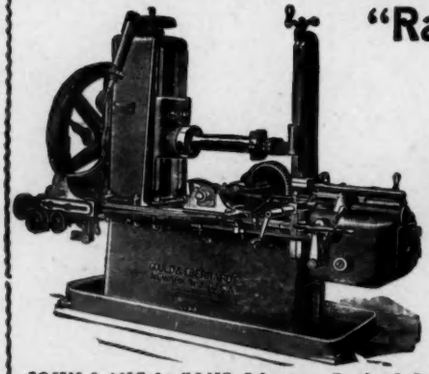

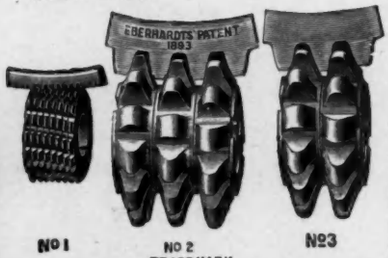


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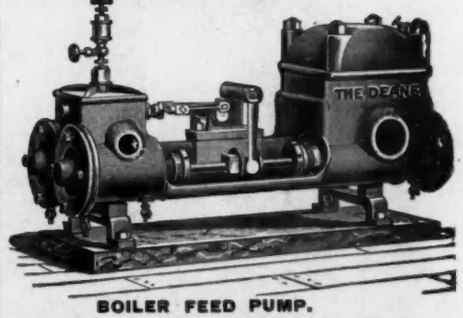


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## Arbors for Lathe Work—A Money Saver—A New Radial Drilling Machine—A Foot Stock for Germany—Higher Drilling Speeds.

I can remember a time, Mr. Editor, when I thought the matter of arbors for lathe work was a very simple thing, but my point of view on the question has changed several times. At first I knew them only as odd pieces of iron, picked up about the shop and turned (and—must I confess it?—filed) to fit the job—the most expensive and at the same time the poorest arbors ever made, yet sometimes used on the "Hobson's choice" plan; but I have them to thank for my first good practice in calipering. If I failed the first time I turned the arbor up further, if there was room; if not, I hunted another piece of iron, and acquired more caliper-ing practice.

Next I used arbors made in a factory where they knew lots about arbors, and these arbors were in sets that looked beautiful as they lay upon the tool-room shelves. They were hardened and ground, had centers in them not half large enough for the work they were expected to do, and were tapered uniformly one-hundredth of an inch per foot with actual nominal diameters midway of their length. No straight hole ever fitted these arbors throughout its length. The fit was tight at the upper end—tight enough to drive all right—but was loose enough everywhere else to allow the other end to wobble about considerably if the work covered any considerable portion of the arbor, and it was only by accident if work ever came off these fine arbors true.

Later, when I rose to the dignity of a tool-maker and formed the acquaintance of universal grinders, I ground arbors straight and dead to size for about three-fourths of their length; then tapered them sharply the rest of the way.

These arbors did very well so long as the work was precisely the right diameter to fit the straight portion closely. But reamers will wear and holes will vary, and when a very little too small the work would not go onto these arbors, and when a little too large it wobbled upon them as badly as it did upon those that were tapered all the way.

I have concluded that the arbor question is not as simple as it looks, and was especially interested therefore in some arbors I saw not long ago in the shops of Prentice Bros., in Worcester, Mass. They are making and using a form of arbor shown by the accompanying sketch, and find it very satisfactory, both for regular lathe work and for use in the flat turret lathe; for which latter purpose especially one great advantage is, that it need not be removed from the lathe when work is to be taken from or put onto it.

In the sketch Fig. 1, *a* is the body of the arbor, which has a groove milled in it, as shown, and a piece of polished drill rod *b* is laid in this groove. The work is put on the arbor, over the wire; not driven on by heavy and more or less disturbing blows, as is usual, but "twisted on" by hand, the fits being kept close by a system of repeated hand-reaming. When the arbor turns in the direction indicated by the arrow, the wire is wedged tightly between its seat and the work, and drives powerfully. When the work is to be removed, all that is necessary is to turn the work ahead on the arbor, which may be done by hand, or, in the case of smooth-finished work, by wrapping a strap about it, to one end of which strap is attached a wooden handle, the combination making a modified sort of chain pipe-tongs, which is effective and does not mar the work.

At first sight it certainly seems as though all work turned on such an arbor would inevitably run out, since, of course, the wire pulls the work hard against the arbor at one side, and tends to push it away from the arbor at the other; but Mr. Prentice says no such effect is produced to an appreciable extent, and that the work is at least as good and true as when driven onto an ordinary arbor. No one acquainted with the Prentice work will attribute this opinion to a failure to know what good work is; and it is especially to be noted that emphasis should be put upon the point of insisting that the fit of the work upon the arbor must be close, as, in fact, I found it to be in every one of a number of pieces tried upon arbors.

This arbor will undoubtedly throw work out to the extent of the play between arbor and hole; but if the hole is, say, one-thousandth large, which would make it run pretty loose, the work would be thrown out only half a thousandth; and an important point about it, to my mind, is that it is thrown out squarely, if at all, and there is no tendency or chance to make it wobble, as there inevitably will be with any form of arbor that involves the taper principle.

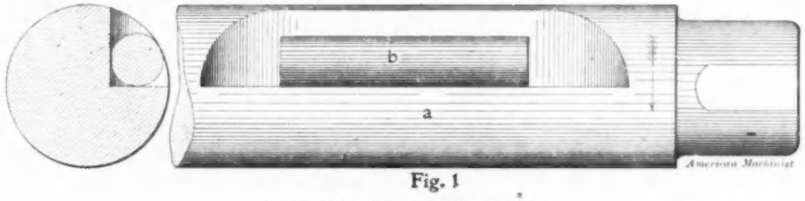



Fig. 1

AN ARBOR FOR LATHE WORK.

### A MONEY SAVER.

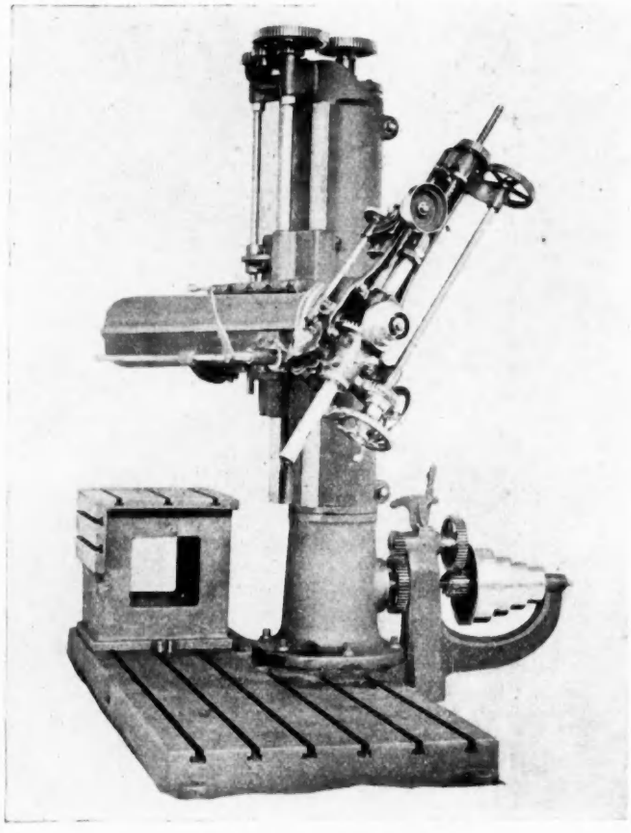
It is easy to see that, besides ideas of their own, Prentice Bros. make use of some of those found in the columns of this journal; and one device which was made from an illustration of yours, and is used here in drilling the holes through drill-press spindles, preparatory to slotting them, has, Mr. Prentice declares, saved thousands of dollars in cost of machine construction in their own and other shops where it has also been adopted. In their own case it, together with improved means of making the taper holes (in a turret machine), has reduced the shop cost of a certain spindle 40 per cent.

### A NEW RADIAL DRILLING MACHINE.

On the floor of the shop I saw the first specimen of a new radial drill, which is shown in Fig. 2, and in which the arm slides in and out, to bring the spindle at any required distance from the column within the machine's capacity. Motion is derived from the vertical shaft passing through the center of the column, by the

spur gears shown at the top, and the vertical splined shaft drives another splined shaft within the arm by means of helical gears.

The arm is moved in or out by the crank and screw shown at the left, and as the head will swing around a complete circle upon the arm, and will drill horizontally if desired, this with the swinging motion of the column upon ball bearings and the vertical and horizontal adjustments give a tool which can drill or bore anywhere within its range in any direction, is handy to manipulate, and the spindle need be no further from the column than is necessary for the job in hand.



NEW RADIAL DRILL PRESS.

### A FOOT-STOCK FOR GERMANY.

Some lathes built here are being sent to Germany, and the Germans object to our common form of foot-stock and like one something like that shown by the sketch much better. This sketch is made from memory, because it seems impossible to get a photo or drawing of it, and it is therefore not strictly accurate, but will indicate the general form. It is somewhat heavier than the regular foot-stock, but is at least as stiff, and it gives much better opportunity for the use of the compound rest at the end of shafts or when doing angular work on short arbors, and also is less in the way of the workman when he is hand-tooling or otherwise finishing the ends of work held upon centers. This foot-stock certainly looks well, and might with advantage be more generally used here as well as in Germany.

### HIGHER DRILLING SPEEDS.

It has been mentioned in these columns that in this shop are found some of the most earnest advocates of higher speeds and slower feeds than are generally considered best for twist drills. In fact, the particular Mr. Prentice, who is the shop superintendent, and whom I do not know how to otherwise distinguish from his brother, says that the Old Testament is precisely as good authority for the speeds and feeds of drills as are the tables that are commonly referred to. He relates an instance of a drill press built by them to the specifications of a customer, who specified the speeds and feeds that were to be provided for. The drill was no more than started in service before a telegram was received announcing that it was a failure. By a visit to the shop it was shown that by greatly increased speed and reduced feed—which last had to be secured for the test by allowing the friction to slip—all the difficulties disappeared. Then, in strict accordance with human nature as we find it, came a claim that alterations must be made at builder's cost, which claim was, however, finally abandoned after some thoughtful contemplation of the fact that a count of revolutions and measurement of feed movement showed that the conditions called for by the specifications had been strictly fulfilled, and the required changes were finally made and the machine rendered satisfactory at the purchaser's expense.

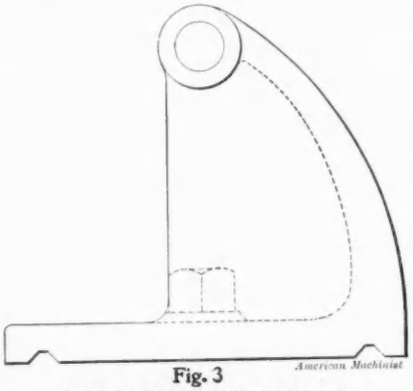



**Fig. 3**

A FOOT-STOCK FOR GERMANY.

S. T. FREELAND.

▲ ▲ ▲

## Extrusion—Pressing Plastic Metals.

A paper lately read before the Iron and Steel Institute of Great Britain, on "Manufacturing Metallic Bars by Extrusion," has attracted considerable attention. The word employed to characterize the process spoken of is not a satisfactory one, but if anyone will try to supply a better he will find that it is not easy to do so. The paper describes a process of pressing metals, at a temperature high enough to render them plastic, into continuous bars of any desired section, often into shapes that it would be impossible to produce by rolling.

The heated metal is placed in a cylindrical chamber with a die at one end, and when pressure is applied the plastic metal is forced through the die. The pressure chamber must be able to stand both the high temperature and the severe pressure, and the main feature of the present invention is in the construction of this cylinder. The course of the necessary experiments was marked by many failures, no metal being found that in a single cylinder would withstand the strains, especially those due to the unequal expansion and contraction with the rapid changes of temperature. The difficulty was finally overcome by dividing the container into sections composed of concentric steel tubes alternating with annular spaces packed with a dense non-conducting material. While steel at a high temperature loses its integral strength, it will at lower temperatures retain its full power to resist pressure, and a cylindrical chamber formed of several comparatively thin walls, each protected from extreme heat, will resist pressure better than a chamber having a thick, solid wall heated to a higher temperature.

The non-conducting material most fully complying with the exacting conditions of the present problem was found, after many experiments, to be crushed granite mixed

with a small proportion of borax, and this material was adopted.

The apparatus, as constructed and now in daily operation, consists mainly of the compressing cylinder and the hydraulic ram. The container is mounted on trunnions, and turned by worm gearing to the vertical position for charging, and restored to the horizontal for pressing. It is 2 feet long and 2 feet in diameter externally. The internal diameter of the inner liner varies from 5 inches to 8 inches, being changed for different charges. The liner is inclosed within a series of cylinders of mild steel with ¾-inch spaces filled with the non-conducting material.

The dies are of tungsten steel; the edges of the openings are beveled to give free access to the flowing metal, and also to condense it. The die is easily removed or replaced, as it is necessary to heat it before each pressing operation, and it is secured in place by grips operated by hydraulic pressure.

The metal is forced through the die by a hydraulic ram 18 inches in diameter, with a pressure of 2 tons per square inch. The ram has a prolongation, or extension, acting as the expelling plunger.

The paper speaks of the apparatus in operation upon Delta metal, making at the time rods 1 inch in diameter and 12 feet long, four at each charge, there being four similar openings in the die. A charge having been just put through, the opening at the die end of the container is closed by a removable stopper, and the container is turned upright. A charge of 168 pounds of molten metal is poured in from a ladle and allowed to stand about six minutes, until it is changed from an actually liquid to a plastic state. The diameter of the plunger being less than that of the steel liner, a dished steel check disk, less plastic and more rigid than the heated metal at the working temperature, is first placed on top of the charge, and when the pressure is brought on, the disk is expanded, completely filling the bore and preventing the back flow of the metal. A heated block is placed between this disk and the end of the plunger, to prevent any chilling of the metal.

This loose block having been inserted, the container is brought into a horizontal position, the stop plate removed, the heated die and die block clamped to it, the hydraulic pumps are started, and in four minutes the charge is expelled, forming four rods each 1 inch in diameter and 12 feet long. The clips are released and the ram continues its forward travel, expelling everything and leaving the container perfectly clear for a fresh charge. The rods are cut from the stump or fag end, the die and holder are replaced by others, and the operation goes on.

The physical characteristics of bars produced by this process are greatly improved. The metal is perfectly homogeneous, and there is an actual increase of strength in the extruded bar over the hot-rolled bar, this varying with the nature and composition of the metal. Ordinary "yellow metal" is increased 24 per cent. in tensile strength, and proportionately in elongation. Official tests of Delta metal extruded bars show 48 tons per square inch tensile strength, and 32.5 per cent. elongation on 2 inches, against 38 tons tensile strength and 20 per cent. elongation for rolled bars of the same metal. The surfaces of the bars are perfectly smooth, and they require no further finish. About 50 charges per day are worked, and the labor cost is low, two men and a boy being sufficient to work the machine.

The system is already in operation in two or three other establishments than that here spoken of. We have here a new industrial process which may eventually reach much farther than at present indicated. While the process has not yet been successfully applied to the extrusion of bars of iron or steel, it seems to be expected that it will be. The working temperatures already attained are as high as 1,000 degrees Fahr.

▲ ▲ ▲

## American Agricultural Machinery in Great Britain.

The American Consul at Dublin has something to say about the exhibition of American machinery at the recent show of the Royal Dublin Agricultural Society, and he seems to have struck at least one idea that will be a surprise to some of our readers. He says:

"As a rule, the English and Irish manufactures are much heavier in make and more clumsy in appearance than the same sorts of American machinery. I was told by some of the exhibitors that this was due to the fact that the iron and steel of American manufacture were tougher than those of England; that a bar of American steel, for instance, would stand a much heavier strain than a bar of English steel of the same weight and thickness. Whether such statements are true I have no means of knowing. But, although they may be true, I am of the opinion that the lighter make of American machinery discourages its sale in this country, and that should our American manufacturers study the prejudices of farmers in this country, and follow the more clumsy fashion of the home-made machinery, they would improve their sales thereby. In harvesters there is also required a greater width of canvas and of binder platform than is common in the American manufacture. This is required because of the length of straw and the habit of taking as much of the straw as possible from the field.

"I believe that in harvesting machinery and hay tools, those of American manufacture are steadily growing in favor. I cannot emphasize too strongly the importance to American manufacturers of agricultural machinery and tools being represented at the principal agricultural shows. It would also be undoubtedly to their advantage could they send a representative to visit the various exhibits of agricultural machinery, and to study their manufacture in comparison with their foreign competitors, so as to be able to suggest changes for the foreign trade which would help to overcome prejudices in the matter of form."

▲ ▲ ▲

## One Pound of Coal on a Steamship.

The value of a pound of coal at different epochs in steamship evolution has been stated in a striking form by Mr. A. J. McGinnis, President of the Liverpool Engineering Society. In 1840 a pound of coal propelled a displacement weight of 0.578 ton eight knots; but the earning weight was only one-tenth of this, as 50 per cent. of the displacement represented the machinery and fuel, 40 per cent. the hull, and 10 per cent., or 0.057 ton, the cargo. In 1850, with iron vessels and the screw propeller, a displacement weight of 0.6 ton was propelled nine knots by the pound of coal; but the proportion of cargo had risen to 27 per cent., or 0.16 ton. In 1860, with higher boiler pressure and the surface condenser, 0.82 ton displacement was propelled ten knots, and the cargo was 33 per cent., or 0.27 ton. In 1870 the compound engine was in full swing, and 1.8 tons displacement was propelled ten knots, and the cargo was 50 per cent., or 0.9 ton. In 1880, in the freight steamer, 2.1 tons displacement were propelled ten knots, with still 50 per cent., or 1.5 tons of cargo. In 1895 there were two classes of freight boats. The "tramp" (working better than the tramp on land) propelled 3.4 displacement tons eight and one-half knots, with 60 per cent., or 2 tons of cargo. At the same time the huge cargo steamers of the North Atlantic were driving a displacement of 3.14 tons twelve knots with 55 per cent., or 1.7 tons of cargo. On the express passenger steamers the cargo weight is down to 0.09 ton per pound of coal.

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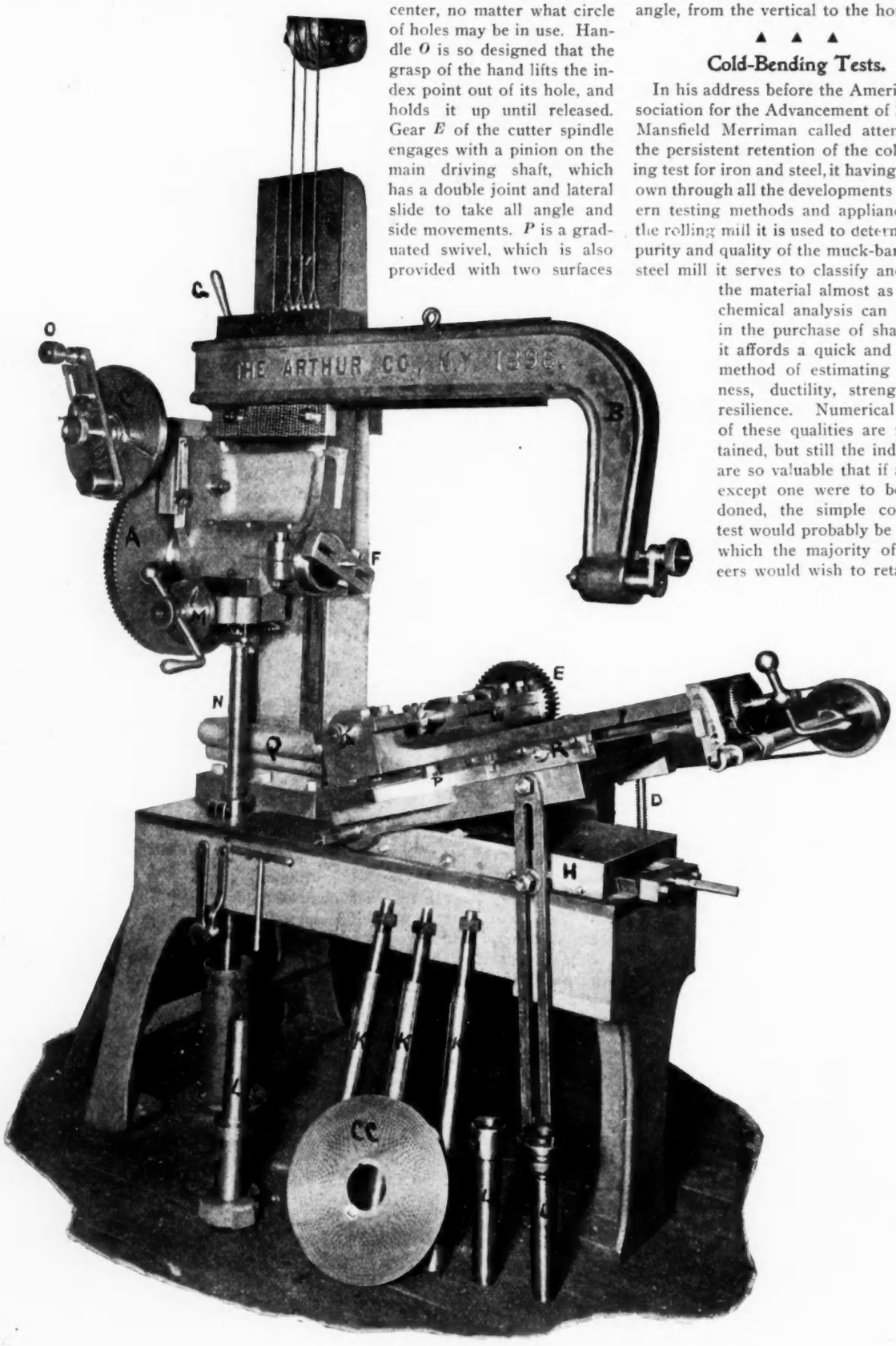
## A Jobbing Gear Cutter.

This machine was designed and built by the Arthur Co., 188 Front street, New York, for their own use in a general jobbing machine shop. The machine is called "semi-automatic," as the cutting feed is automatic and stops automatically, while the spacing is done by hand movement.

The machine illustrated will cut a wheel of any size from the smallest up to 72 inches diameter and 24 inches face, and has sufficient power for the heaviest pitches at a single cut. With wheels of large diameter, the adjustable support *Q* is set against the rim to take the thrust. The arm *B* slides out far enough to take work upon centers up to 26 inches diameter, and for larger sizes taper socket mandrels are used. The head is raised and lowered by dial handle *M*, and is graduated to thousandths of an inch. The head is

counterbalanced and is locked by handle *G*, which tightens all the gib screws at once.

The main worm wheel *A* is 20 inches diameter, with 120 teeth; and in combination with index plates *C* and *CC*, all numbers to 200 are cut, with others running to 24,000. The index arm is counter-balanced, and the handle for turning it is fixed at a constant distance from the center, no matter what circle of holes may be in use. Handle *O* is so designed that the grasp of the hand lifts the index point out of its hole, and holds it up until released. Gear *E* of the cutter spindle engages with a pinion on the main driving shaft, which has a double joint and lateral slide to take all angle and side movements. *P* is a graduated swivel, which is also provided with two surfaces where an angle piece or template may be applied, instead of using the graduations. The long base slide *H* is only used for setting the cutter head in position. Screw *D* sets the upper slide for bevels, or to any angle, from the vertical to the horizontal.




A JOBBING GEAR CUTTER.

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## Cold-Bending Tests.

In his address before the American Association for the Advancement of Science, Mansfield Merriman called attention to the persistent retention of the cold-bending test for iron and steel, it having held its own through all the developments of modern testing methods and appliances. In the rolling mill it is used to determine the purity and quality of the muck-bar; in the steel mill it serves to classify and grade the material almost as well as chemical analysis can do, and in the purchase of shape iron it affords a quick and reliable method of estimating toughness, ductility, strength and resilience. Numerical values of these qualities are not obtained, but still the indications are so valuable that if all tests except one were to be abandoned, the simple cold-bend test would probably be the one which the majority of engineers would wish to retain.

## A New French Milling Machine.

One of our friends, who is traveling in Europe at present, sends home a circular of a French tool-builder (P. Huré, 218 Rue Lafayette, Paris), which circular illustrates and describes something that

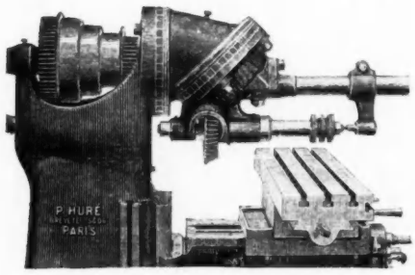


Fig. 1. SPINDLE HORIZONTAL.

we believe is really new in milling machines. We have reproduced as well as we can the engravings shown in the circular, and, in addition, show some dia-

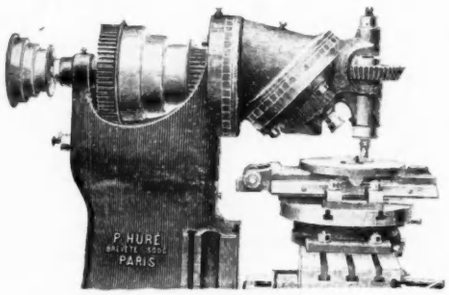


Fig. 2. SPINDLE VERTICAL.

grams that represent our guess as to how the gearing is arranged.

The special features of the machine are, that the arbor can be set at any angle from vertical to horizontal, can be placed horizontally either in line with or across the platen, and can be set to any desired angle in a horizontal plane, as for cutting spirals, doing away with the necessity for a swivel to the table; and all this can be done without attaching to or detaching from the machine when making changes.

Fig. 1 shows the machine with the arbor in its usual position; Fig. 2, with the arbor vertical; Fig. 3, set at an angle for milling teeth as shown, by movement of the saddle on the knee; Fig. 4, set horizontally in line with the platen for boring, drilling, facing, etc., and Fig. 5 shows the complete machine as set for milling a helix.

It will be obvious that there are two joints in the overhanging arm or trunk, one of these being in a plane which is 45 degrees from the other. Both flanges are graduated, and binding bolts secure them in any desired position.

No explanation of the arrangement of gearing is given, but it is obviously as shown in Figs. 6, 7 and 8, in which *a* is a bevel gear on the end of the main spindle, *b* a similar bevel gear driven by *a*, *e* a bevel gear fastened to *b*, and *d* the gear seen in the general engraving and which is on the cutter spindle.

It is obvious that by loosening the bolts in the first or vertical joint, the entire trunk can be rotated about gear *a*, and that gear *b* may be thus driven from any posi-

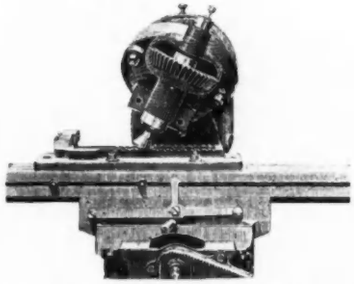

Fig. 3. SPINDLE AT AN ANGLE IN THE VERTICAL PLANE.

tion on the circumference of *a;* and that, by releasing the bolts in the other joint, the outer portion of the trunk carrying the cutter spindle can be rotated to any desired position, gear *d* being thus rotated about *c*, to be driven from any point on its circumference. The result of the two movements is that any conceivable position of cutter spindle can be obtained.

The idea is certainly ingenious, and a number of advantages of such a machine will readily suggest themselves. It certainly is not a handsome machine, however, and there is necessarily more overhang of the cutters than is necessary with the regular type of machine. The trunk

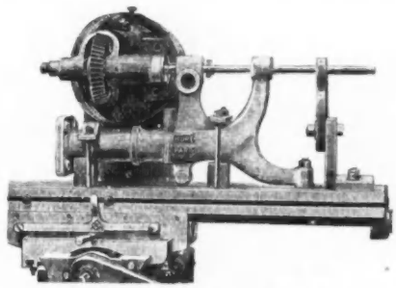

Fig. 4. SPINDLE HORIZONTAL, FOR BORING.

is of large diameter, to give stiffness—so large as to make it very clear that the weakest point is through the upright of the machine, just below the main spindle box, and that a tie-beam extending over the cone pulley from one upright to the other would greatly strengthen it. The necessity for removing and attaching the overhead arm, and the fact that it cannot be used except when the cutter spindle

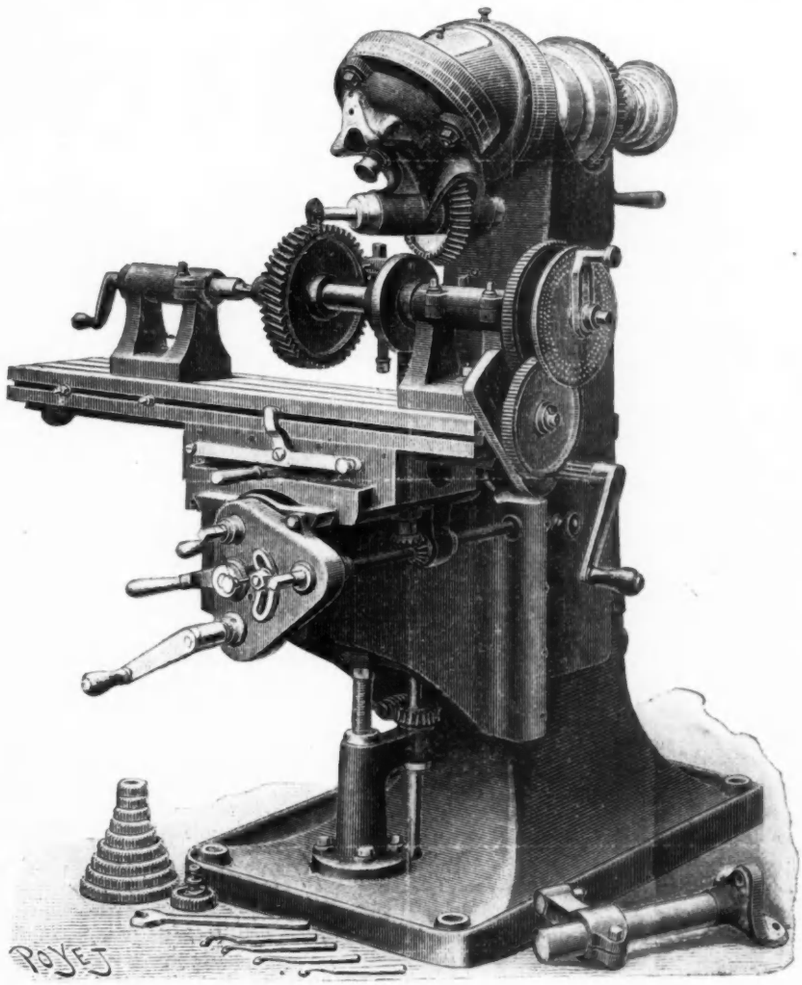


Fig. 5. A NEW MILLING MACHINE—SPINDLE SET FOR MILLING A SPIRAL.

is in a horizontal position across the platen, would also be some objection.

As for the rest of the machine, there is not much to say, except that it has automatic feeds in all (six) directions and micrometer graduations on the traversing screws. It is certainly more of a universal machine than any that has previously come to our notice; and assuming it to be a fairly heavy machine for light work, it ought to hit almost any job that could present itself.

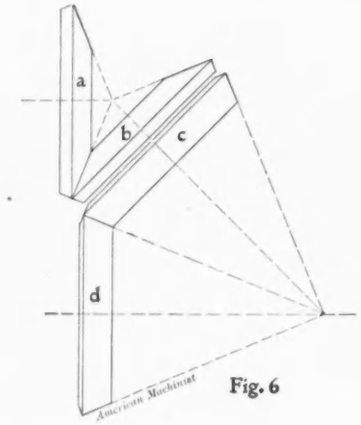

Fig. 6

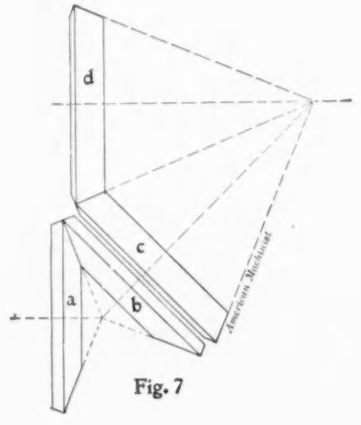

Fig. 7

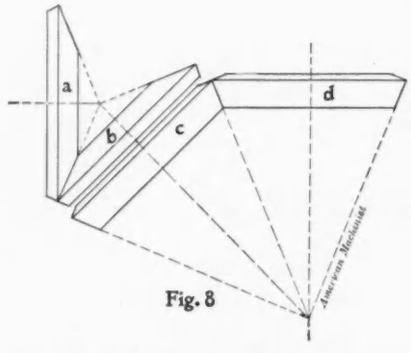

Fig. 8

PROBABLE ARRANGEMENT OF GEARING IN MILLING MACHINE.

When the arbor is in its lowest horizontal position it is 35 centimeters, or 13¾ inches, from the platen, and when in its highest position (indicated by Fig. 7) it is 70 centimeters, or 27½ inches high.

## Manufactures in Japan.

Mr. F. F. Prentiss, of the Cleveland Twist Drill Co., has recently returned from a trip to China and Japan, and in conversation the other day remarked that there was far less to fear from the competition of the Japanese in manufactures than many people have been led to suppose.

He thought they were doing very well in the manufacture of silks and in some other lines which they had been carrying on for a good many years, but that in the construction of machinery they were as yet novices, and that American and English machine builders would have nothing to fear from them for a long time to come at least.

Speaking particularly of the Japanese bicycle story, regarding which there was an effort to make a sensation some time ago, he said it was true that some bicycles were made in Japan, but that these machines were made one by one, each machine without much regard to any other machine similar to it; that the interchangeable system of manufacture was not employed in their construction at all, and that, so far as the quality of the machine built is concerned, it was very poor, since they succeed apparently in imitating the appearance and seem to leave out the substance, or in other words, the quality of material and workmanship which make such a machine useful for the purpose intended. He thinks they have no conception of what we call the interchangeable system of manufacture, and that they must have a great deal of training before they can master and make use of any such system.

In illustrating the character of work done by the Japanese, Mr. Prentiss referred to a pair of tan shoes which he was wearing at the time. These shoes were made in Japan, and so far as anyone could judge from the appearance might have been made in Lynn, since the appearance of a modern style of American shoe was perfectly imitated; but when Mr. Prentiss had worn these shoes three days, the soles came off from them completely, and as he desired particularly to keep them, he was obliged, in order to do so, to have new soles put on.

Other evidence is not wanting that Japanese competition in manufacturing is a "bugaboo," and we shall present more of this evidence in future issues.

China, Mr. Prentiss thinks, is making, and will make, great strides in manufacturing and other activities of modern civilized life, and he remarked particularly upon some immense dry docks which he had seen at Hong Kong. These docks, it seems, have been put in by the aid of a subsidy from the British Government, which desired facilities in that quarter for docking war vessels; and the capacity for handling vessels there is, Mr. Prentiss states, much greater than can be found anywhere in this country.

## Mr. Victorin at Sandy Hook.

The "Daily Times," of Troy, N. Y., in its issue of June 23d, has the following:

"Anthony Victorin, constructing engineer of the Watervliet Arsenal, has been transferred to the Sandy Hook proving ground, in connection with the work on gun carriages. He will leave for his new post at the end of the week. Mr. Victorin is subject to transfer by the Chief of Ordnance, according to the work required in the different arsenals of the department. The construction of the gun factory at Watervliet is practically completed. In the past Mr. Victorin has been compelled, in connection with work at the arsenal, to devote his attention to work in other arsenals. He came to Watervliet nine years ago next month, and during that period has performed valuable work for the department. Most of the special machinery, particularly the heavy gun lathes, was designed by Mr. Victorin. He made a number of improvements in breech mechanism for cannon, and some of these have been adopted abroad. The plant at Watervliet is unique in its composition and equipment, and stands alone in the world in this respect. Mr. Victorin has been frequently complimented for his valuable services in connection with the construction of the plant. Mr. Victorin is a manager of the Pafraets Dael Club and a member of the Laureate Boat Club and the Fort Orange Club of Albany. He stands high in his profession, and is an honored member of the Engineers' Club of New York, the American Society of Mechanical Engineers and the American Society of Civil Engineers. During his connection with the arsenal Mr. Victorin has made many friends, who will wish him success in his new field of endeavor."

▲ ▲ ▲

## Written by the Author.

"The Engineer," of London, in reviewing our Mr. Richards' book on Compressed Air, says, along with other complimentary things: "It has been written by the author, and bears the impress of originality of treatment."

The expression "written by the author" has a peculiar sound, but no one familiar with technical books will be at a loss to understand what it means, and that it is intended to distinguish Mr. Richards' work from that numerous class of books written by men who have had little or no practical experience with the work of which they write, and who therefore depend mainly, if not exclusively, upon what has previously been written upon the subject; so that in substance and ideas, if not in actual forms of expression, the books are nothing more than repetitions of what has gone before, and are absolutely innocent of even an attempt to present a new idea or to add to our store of actual knowledge.

## Bicycle Tools—XXVII.

As previously remarked, there is a great difference in the wheel-assembling methods of the various shops. These differences arise from different ideas as to the shortest way of reaching a true wheel. Wheel assembling, or wheel "stringing," can be done more quickly, perhaps, without any sort of a fixture than in any other way. In the Western wheel shops the stringers sit at a wide bench, as shown in Fig. 171, and hold the wheel either on the bench, or with one edge on the bench and the other on the workman's belly. All the practice of the Western wheel shop is worthy of close attention. The shop is under extremely good management, and no job is allowed to cost more than is needed to produce good, solid, reliable work. In the Lozier shops, also, the wheels are assembled with no fixture, by quick boys standing at the bench, as shown in Fig. 172. Extreme attention to detail-aids in quick handling prevails in the Lozier, as is evidenced by the nipple rack and spoke trays, so constructed and placed that a single nipple may be picked up with one motion from the rack, while a spoke tray stands on both the right and left sides of the workman, who assembles a wheel in an incredibly short space of time, merely bringing the spokes flush with the nipple ends. As the spokes are exactly alike for length, it is obvious that this method brings the wheel rim pretty close to true with the hub. The St. Nicholas method is in effect the same, as the three bent arms radiating from the wooden standard, as shown in Fig. 173, have no jaws or rim-locating devices on them, but simply serve to support the wheel rim, the hub being carried on a pin driven in the top of the wooden post. The boy is shown in Fig. 173, in the act of filling the first hub flange with spokes, before setting it on the hub pin; here, too, wheels were assembled with great celerity, and the fixture is a very cheap affair. At the Sterling (old shop) a stringing stand composed of an iron base, a steel-rod upright fitted to take the hub at the top end, and carrying a hub with three up-curving arms which support an annular wooden table, cut away at one side for a short distance, all as shown in Fig. 174, is used. The rim is laid on the annular wooden table, without locating guides to fix its position with reference to the hub, and is turned at will to bring the desired portion of the wheel over the opening or gap in the table top, for the convenience of the stringer, who sits at his work. This is a very handy stringing stand, but is perhaps no more rapid and no easier on the workman than the Lozier plain table. As to the choice between sitting and standing, it is perfectly well known that where a workman can stand in a natural position, as a vise hand stands at the vise, or as the wheel stringer stands in Fig. 172 (Lozier), it is easier to stand than to sit. If, however, the hands have to maintain a constant position, as in some kinds of small tool work, a seat is absolutely needed. In the Lozier shops piece-work pay prevails, and the workmen are pretty likely to take the position which is most conducive to quick results.

The Gormully & Jeffery stringing stand, Fig. 173, has a tripod base, with a 4-arm spider carrying adjustable rim supports which are furnished with rim-locating gages; the gages are used on only three of the arms of the machine in the foreground, and in later photograph no gages are used, and the supporting arms are covered with cloth to avoid injury to the varnished rim surface. Most stringing fixtures were first used for assembling steel rim wheels.

After the stringing comes the wheel truing, a separate operation which must be performed in all cases, no matter how elaborate the stringing machine may be, and some of the stringing machines are very elaborate indeed. Previous to going to the truing machines the Lozier wheels are partly or roughly trued on a machine

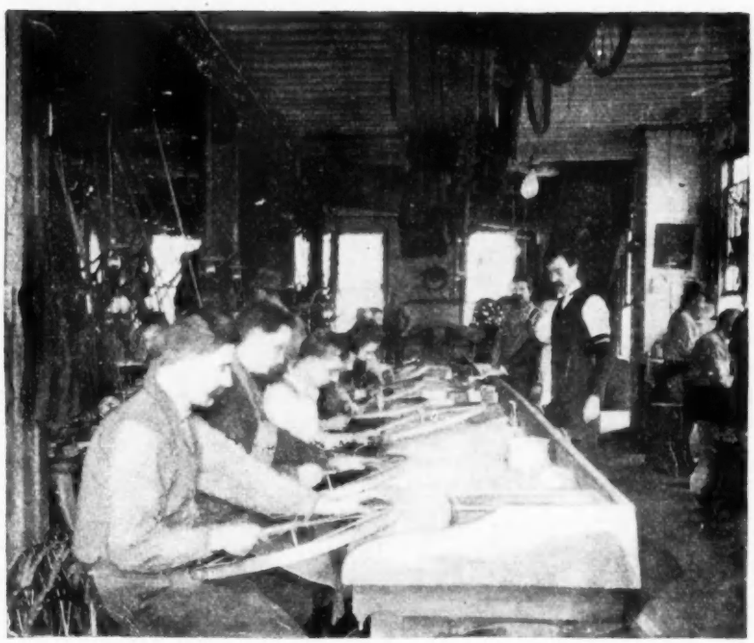

Fig. 171. STRINGING WHEELS—WESTERN WHEEL WORKS.

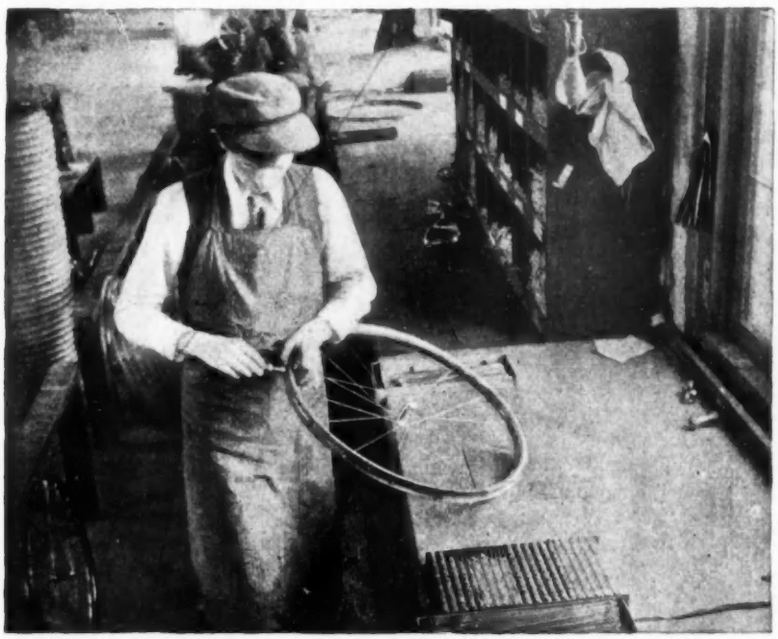

Fig. 172. ASSEMBLING WHEELS—LOZIER SHOPS.

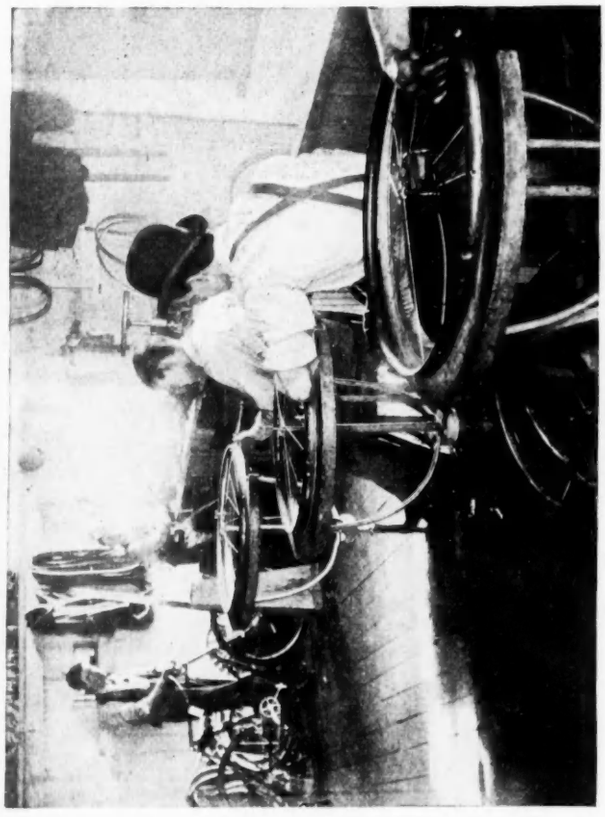

Fig. 174. STRINGING WHEELS—STERLING SHOPS.

Fig. 176. SECOND OPERATION OF WHEEL ASSEMBLING—LOZIER SHOPS.

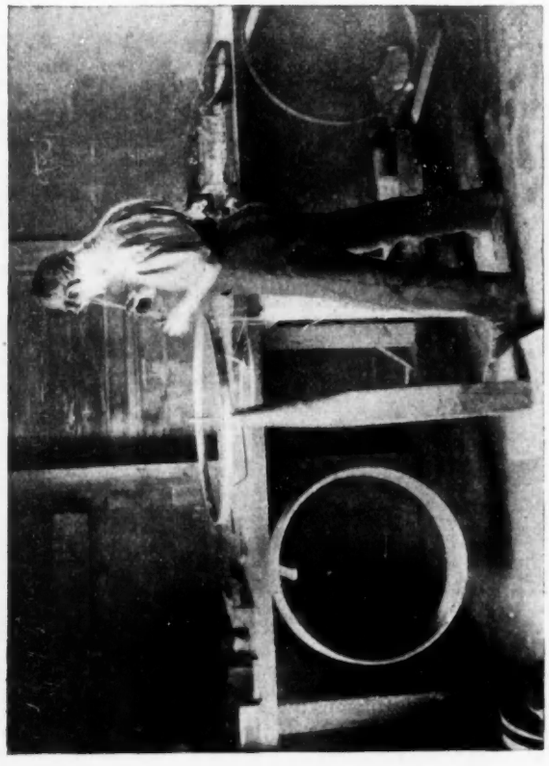

Fig. 173. STRINGING WHEELS—ST. NICHOLAS SHOPS.

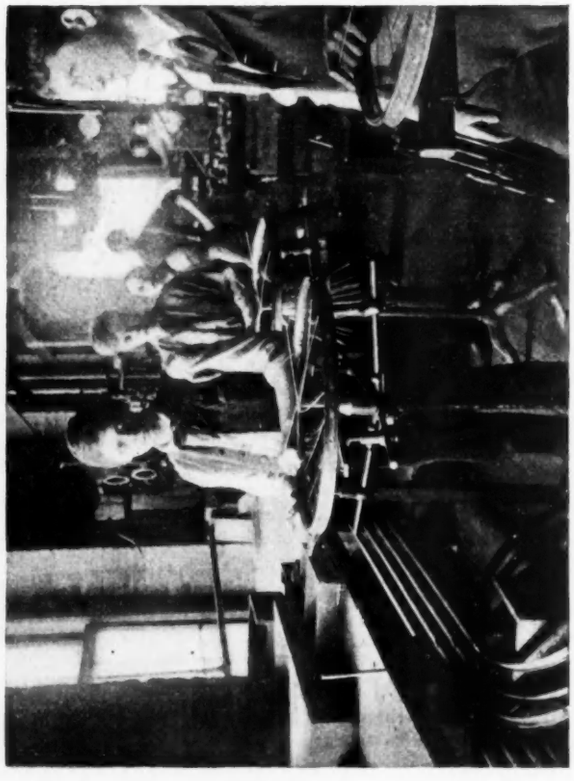

Fig. 175. STRINGING WHEELS—GORMULLY & JEFFERY SHOPS.

which has a revolving annular table set on a bench, as shown in Fig. 176. In this machine a guide or gage ring is plainly marked on the wooden ring which supports the rim, this gage ring-mark being concentric with the metal hub-supporting pin; here the wheel is trued until the rim lies flat on the table and is fair with the gage ring-mark. This operation saves time in the final wheel truing, where the wheel revolves on its own axis.

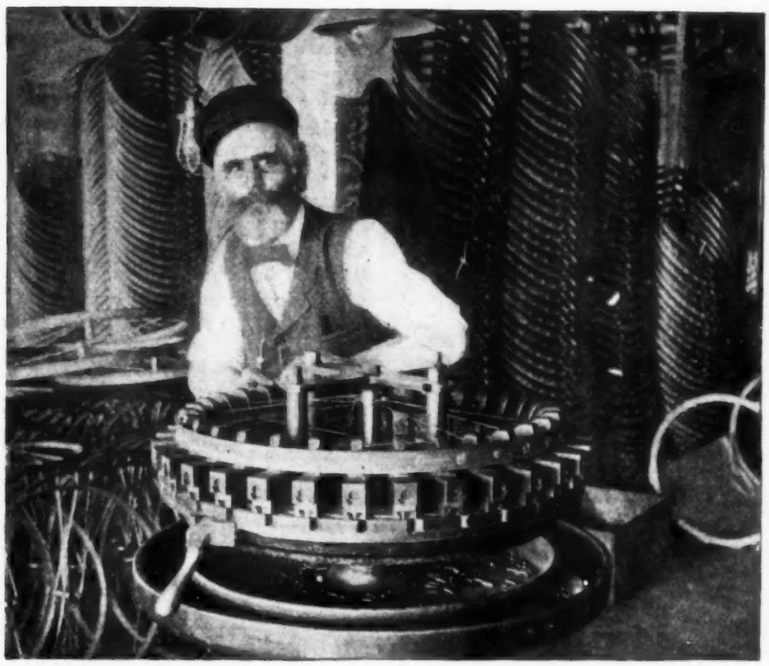

Fig. 177. STRINGING WHEELS—MONARCH SHOP.

Fig. 177 is from the Monarch shops, Chicago, and shows the Pratt & Whitney bicycle wheel table in use. This is a multi-jawed, cam-slot expanding table; each jaw is double, and has an adjusting screw for moving each rim-holding jaw on the cam-slot-actuated shoe to which the jaw is dovetailed. This machine also has a pan under the revolving jaw-carrying table, a latch stop for an abutment when the cam-slot ring is moved by the opening and closing handle, all mounted on a substantial cast-iron base or column. A similar machine, designed by Mr. Schrader, superintendent of the Liberty shops, formerly of Rockaway, N. J., now of Bridgeport, Conn., is shown in Fig. 179. These machines are intended to locate a rim so perfectly concentric with the hub pin as to bring the wheel off true after stringing, and at the Liberty shops I was told that the saving at the truing stand was so great as to amply warrant the use of such an elaborate and expensive tool. These Pratt & Whitney and Schrader-Garvin "wheel tables" are not universally used; the shops which do use them consider them indispensable; those that do not use them claim that a wheel can be just as cheaply made true without them as with them. The truth seems to be that these machines really do bring a wheel very nearly true, if the spokes and nipples fit each other well; this is often not the case, and where one nipple screws very hard on its spoke and another turns very easily, it is difficult to avoid an uneven spoke tension, and a consequent want of rim truth when the wheel comes off the machine. At the time the Monarch picture, Fig. 177, was taken, the nipples and spokes were so far from uniformity that often two or three nipples would be tried before one would take the spoke, while others went on slack, and the wheel truers were spending a good lot of time on each wheel to make it run right. A wood rim is a very slender, frail thing, and can be pulled into any shape with the nipple and spoke screw; and again, many rims have stiff places in them, where it takes quite a pull to make the rim yield at all, while in other places the rim will move if it is "looked at," the slightest pressure being enough to change its form materially. A wood rim may be a true job when it comes from the rim-maker's lathe, or it may be "wavy" edgewise, so that if laid on a surface plate the rim would lack a good deal of touching the plate in some spots. But when the wheel leaves the truer's hands it is expected to run very nearly true, and does do so. After a wood rim wheel has been trued it is not certain to stay true; indeed, it is almost certain that a wheel which runs almost perfectly true when it leaves the truing stand, will show considerably "out" if placed again on the tru-

Fig. 179. WHEEL-TRUING MACHINE.

ing stand after it has been allowed to lie by itself, untouched, for half an hour. When this fact is taken into consideration, it seems not improbable that the Lozier 3-stage operation of assembling wheels has a merit which does not appear at first sight. The interval of time which must, in the natural course of shop events, elapse between the second operation, Fig. 176, in which the rim is made to lie flat on the annular table, and the final truing, may be of considerable value in seasoning, ageing, or ripening the wheel-rim, and so make the final truing more likely to be permanent. Tool-makers are well aware that forms of metal which involve tension and compression of material, change if left at rest, and that this change progresses slowly through long periods of time in case of, for instance, steel gage plugs and rings. Experienced gage-makers rough-grind a plug and ring nearly to gage, and then let them stand a year or eighteen months before finishing them, if they expect to make a fine job that will keep its shape. A wood rim has its zones of tension and compression, often within a minute margin of the cohesive strength of the material in the tension-strained portion, and the shape of a rim is sure to change after stringing and truing. This change is very rapid at first and constantly grows slower, so that a time interval of only an hour or two between rough truing and finished truing may be of great actual value.

The tools used by the stringers for turning the nipples quickly include the single and double crank brace, the spiral screw driver with sliding nut, and single ratchet screw drivers. The brace is often special, and often a common, very light wood-worker's brace. The double crank or "ship-auger" brace is made of a single rod of $\frac{1}{4}$ or $\frac{5}{16}$ inch round tool steel, with the crotch screw driver fitting the nipple head on one end, and the other end bent into two cranks, 180 degrees apart. The quick spiral shank screw driver, with a sliding nut to drive it in either direction, is a well-known tool which need not be described here. The spiral screw driver and the single-crank brace screw driver are shown in Fig. 176. HUGH DOLNAR.

# ELECTRICAL MACHINERY.

## Building of a Great Dynamo.—IX.

No one who follows electrical work through the shops can fail to be impressed with the great amount of careful, painstaking work hidden away in the dynamo, no matter of what style or pattern. A well-finished Corliss steam engine looks like a very elaborate example of mechanism, because a large part of the work is on outside pieces and shows for all it is worth in the running machine. A dynamo is another thing altogether; hundreds of hours of work are hidden away, buried out of sight on pieces which are busy with invisible duties; they work, but do not move, and the dynamo no more shows its hidden organs and the subtle labors they perform than a living animal shows what goes on in the varied and complex system of power-transmitting mechanisms which are hidden from view by the hide of, say, the horse or the ox.

There is plenty of work on the radial magnets, and there is also a lot of plain planer work on the magnet caps, *C C C C*, Fig. 32. These come to the shop in the form of plain slabs of steel, and are first finished to width by planing the edges, and are next clamped down to fill the planer table and have the inside face and the two beveled ends planed. They are then turned over on the planer and have the outside curve planed roughly to shape. Lastly, they are drilled and counterbored for the four holding bolts. Then the whole machine work of the center magnet, radial magnets and caps is assembled and bolted up hard with the fork wrench, which fits the bolt heads, and the job goes to the boring mill as shown in Fig. 34, where it is spotted on a hub bolted to the table and turned to fit the spot ring bored in the center magnet, and the outside and edges of the magnet caps are turned off perfectly true.

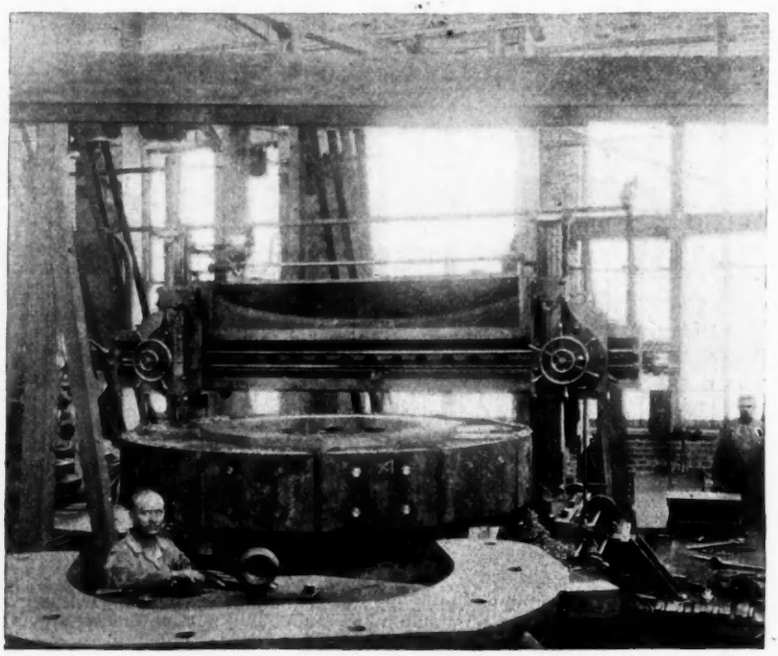

Fig. 34. TURNING THE MAGNET CAPS.

This finishes the frame-work of the magnet and brings the job back once more to the winding-room, where the magnet cases which are to surround the radial magnets are fitted with the "shunt" and "series" winding of insulated wire which makes this elaborate magnet structure do its work.

This whole structure of the magnet, built up of the massive duodecuple-faced center magnet, the radial magnets and magnet caps, is stationary and the armature revolves around it, and it is this revolving of the armature close to the center magnet, but not touching it, which generates the electric current. If the armature is revolved very slowly, only a very feeble current is produced, and the armature turns almost as easily as if the center magnet was not in place. As the velocity of the armature increases, the current increases, and the power required to turn the armature increases to such an extent that at no very great speed the armature as described requires the full power of a 1,500 horse-power steam engine to keep it in motion, and this motion will furnish a current of electricity which can be put through an electric motor of a generally similar construction to a dynamo and made to give out in motion the larger part of the power which the steam engine expended in turning the dynamo itself.

The magnet castings, Fig. 35, are square sheet-iron open-ended structures, of such size and length as to slip easily on the radial magnets and be held between the magnet caps or "pole shoes" and the flat faces of the center magnet. The outside of the boxes is insulated most carefully with asbestos, mica, "anti-thunderbolt paper" and pasteboard, with a final cover-

ing of "electric" tape, or linen tape, either being used. The insides of the boxes are thoroughly covered with several coats of zinc white paint. The winding on these boxes is compound, or "shunt" and "series," with insulated wire, some of which is covered with tape by a machine called in the Siemens-Halske shops a "cable-covering" machine. H. L. A.

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## The Action of Shunt and Compound-Wound Dynamos.

BY WM. BAXTER, JR.

The action of shunt and differentially-wound machines when used as motors has been considered in articles under these heads, and their action as generators will be readily understood from what has preceded.

Generators used for incandescent lighting and for generating electricity for power purposes are desired to deliver a current of constant electromotive force; that is, constant at the point where used—not where generated. This is an essential difference between the conditions of motors and generators. The constant electromotive force with which the motor is supplied is measured at its terminals; but the constant electromotive force which it is desired the generator shall supply is at the other end of the line after the line losses have been taken out, and these line losses have an important influence on the design of the generator, which, of course, they do not have on the design of the motor.

If a shunt-wound dynamo is run at a constant speed, it will maintain a nearly constant electromotive force at its own terminals. If such a machine, when running as a motor, will not vary the speed more than one per cent. between full load and no load, when run as a generator it will not vary the electromotive force at its terminals more than one per cent. between full load and no load, providing the speed is kept constant. The best steam engines, however, will not run at the same speed with full load and no load. As the load increases, the speed will decrease, and at full load will be three or four per cent. less than when running light, even with the best engines. On account of this change in the speed of the engine, the shunt-wound generator cannot maintain a very constant electromotive force; nevertheless, it will be sufficiently uniform for private installations, because in such plants the wires are short and the line loss small, and the variation of electromotive force due to the variation of speed is not sufficient to require compensation in the design of the generator.

For large lighting stations and railway work, the shunt winding is not suitable. In these cases the current has to be transmitted to a considerable distance, and a certain portion of the electromotive force is used to overcome the resistance of the line. The electromotive force so used is commonly called the "line drop." The electromotive force used up in the line is the product of the current by the resistance of the line. Consequently, the amount used up in the line will increase as the current increases; and if the electromotive force supplied at the terminals of the generator is constant, it will not be constant when measured at the other end of the line, but will drop as the current used increases. To compensate for this, the generator should be so wound that as the current delivered increases, the electromotive force at its terminals will also increase. In this way the electromotive force at the other end of the line may be kept approximately constant.

The line drop may be less than one per cent. of the applied voltage with a small current, and it may be more than ten per cent. with the maximum current. It may be reduced by increasing the size of the wire; but this is an expensive method, and where the wires are long it may be cheaper in the long run to submit to considerable line loss rather than incur the expense of enlarging the whole line wire, and then compensate for the line drop under heavy loads by properly designing the generator.

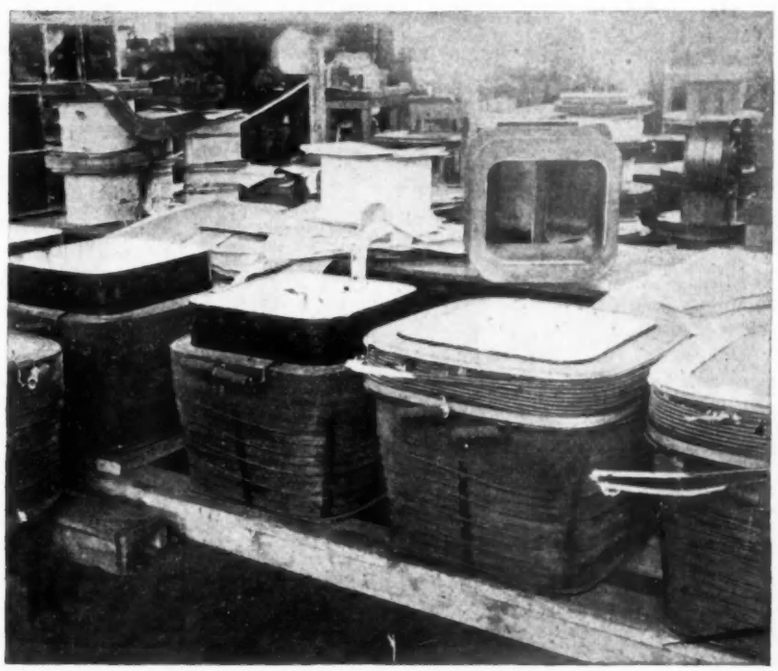


Fig. 35. "BOXES," OR MAGNET CASINGS.

Generally, the line wires are made of such size that the drop at full load amounts to somewhere between five and ten per cent. If we take the line drop at an average of five per cent., and the reduction of engine speed at three per cent., and add these to the one per cent. variation in electromotive force that the generator would give when running at a constant speed, we will find that the total change will be about nine per cent. The effect of this amount of change would be that when all the lights were burning they would be dim, and when only a few were in use they would be very bright. It will also be noticed that the lights nearest to the station would remain the most constant, because with these the line drop would be the least. In order that the generator may be able to make up for the reduction in the speed of the engine as the load increases, and also for the increase in line drop with increase of current, it is necessary that it should be so wound that the electromotive force at the generator terminals will increase somewhat as the current increases. A shunt-wound machine cannot do this; but if the shunt coils are assisted by a few turns in series with the armature, the result may be accomplished. Such a machine is called a "compound-wound machine." It differs from a differentially-wound motor only in the direction of the current through the series coils. In the differential motor the series coils counteract more or less of the effect of the shunt coils; but in a compound-wound generator the series coils help the shunt. As the series and shunt coils work together in a generator, it will be seen that as the current generated increases, the action of the series coils will increase, and therefore the field will be strengthened and the electromotive force increased.

When a generator has so many turns of wire wound on the series coils that the electromotive force increases as the current increases, it is said to be "over compounded." For all station work, generators should be over compounded, so as to compensate for the increase of drop

on the line with an increase of current. The over-compounding should be enough to maintain a practically uniform electromotive force at the lamps or motors located at a distance from the station equal to the average between the nearest and the furthest.

For railway work, generators are generally over compounded ten per cent.; that is, if they ran at a constant speed, the electromotive force at the terminals of the machine would be ten per cent. higher at full load than at no load. This amount of increase compensates for the reduction in speed of engine as the load increases, and also for a part of the increase drop in the line; the result being that the cars that are midway between the power house and the end of the road will be supplied with the average electromotive force of, say, 500 volts, but those at the end of the line will have somewhat less than this, and those near the power house considerably more.

From these explanations of motors and generators of the constant potential type, we can see that regulation of speed in the motor, and electromotive force in the generator, is effected without in any way complicating the mechanical construction of the machine.

▲ ▲ ▲

Now that the compressed-air street car is beginning to attract the attention it deserves, it is interesting to note the unanimity with which the electrical journals pronounce it to be foredoomed to failure for reasons which to them are apparent from the most superficial glance. When one quarter, or even one-tenth, as much money has been expended in developing the compressed air car as was required to bring the electric car to the practicable stage, it will be time enough to talk of failure. In the meantime it is enough to know that men who have given the matter thorough study, and whose capacity cannot be questioned, consider the compressed-air car of decided promise. We shall all know more about it in the near future.

▲ ▲ ▲

The gas engine for dynamo driving on a large scale does not appear to be successful in Great Britain. At Coatbridge the gas plant has been replaced with steam; at Morecombe the station has been declared a public nuisance, and at Belfast it has been practically decided to replace the gas engine plant with a steam plant capable of filling the future requirements of the city.

▲ ▲ ▲

The very latest electrical device is a harpoon for electrocuting whales. A 10,000-volt dynamo is to be placed on the whaler, the current being carried to the smaller boat, which goes out to capture his whaleship, by a cable carried on a reel. The first harpoon is expected to do the business. The scheme is due to Captain Herschel, of Halifax.

# Letters from Practical Men.

## Low-Cost American Machinery.

Editor American Machinist:

In your paper of May 21st appears what pretends to be a statement by the President of the Mergenthaler Linotype Co. to the effect that the Linotype machines are made cheaper in Brooklyn than the company succeeded in producing these same machines in a German factory in which it held an interest. As the inventor of the machine referred to, and as a stockholder in both the American and foreign companies and fully familiar with the facts in the case, I herewith pronounce the above statement as devoid of truth from beginning to end. The manufacture of my invention was never attempted in Germany; the Mergenthaler Linotype Co. never held an interest in any German manufacturing company, and no tools employed on the machines in this country have ever been used on the same work in Germany. Your readers have been imposed upon, and I consider it but fair to them that you publish a denial of the statement in your next issue.

OTT. MERGENTHALER.

Baltimore, Md.

[Not wishing to have our readers remain "imposed upon," we addressed a letter to Mr. P. T. Dodge, President of the Mergenthaler Co., informing him that our statement, based upon a conversation with him, had been called in question, and asking him to affirm or correct it. In his reply, Mr. Dodge says we were in error as to the foreign country concerned, and that it was England instead of Germany. The balance of the statement, i. e., all the real essentials of it, are confirmed by Mr. Dodge, so that we do not feel as though our readers had been very seriously imposed upon by our misstatement, which was obviously due to a lapse of the memory; the cost of machine work in several foreign countries having been under discussion at the same time, we, with apologies to "Pinafore," mixed those countries up.—Ed.]

▲ ▲ ▲

## Clearing Out Waste Pipes.

Editor American Machinist:

You might—if you have lots of space and nothing to put in it, a trouble that I presume is never known in journalism—tell "Water Service" that the expense and ingenuity displayed in his device for clearing out a sink spout has interested us greatly. Up this way we pull in the garden hose, remove the grating from sink, wrap a rag around the hose nozzle, jam it down the outlet of sink, screw the other end of hose to faucet in place of filter and turn on the water. We get our hose put away about the time he gets his tools out.

C. E. QUIMBY.

Tilton, N. H.

## Placing Lathes.

Editor American Machinist:

The question which "Novice" asked in your issue of June 11th is one in which I am much interested. I have always thought that I preferred a lathe placed so that the workman was between the machine and the windows, on the ground that the man could move to one side or the other and get out of his own light, while in the other case the work is usually casting a shadow on the cutting tool. If the workman is on the side next the windows then he is handy to a bench if wanted, or perhaps he is continually getting in the way of bench hands. My greatest difficulty is that I always want to place two rows of lathes back to back to save room, or else two rows face to face so that one man can run two opposite machines. In either case one is right and the other—well, it isn't as good.

The most satisfactory, and at the same time the most criticised, arrangement that I have had anything to do with was in placing lathes in rows across the room with benches down the sides. The end lathes of each row were convenient to the benches, and the lathe hands did not interfere much with the bench hands. The light was very good, as good I think as you can average in a shop lighted from the sides only, and we could get more machines in the same room in convenient positions without the use of any more shafting and belting than were necessary to cover the floor of the shop with tools set the other way and with a line shaft down the middle.

Will somebody tell me how he likes running two lines of shafting through a room, one beside each wall? I have wanted to try it, but have not had an opportunity. It seems as if it might allow one to cover the floor space pretty well without putting up intermediate shafts.

E. H. F.

▲ ▲ ▲

## A Machinist's Labor-Saving Invention.

Editor American Machinist:

Mr. Redfield's remark to the effect that if our Edisons, Thomsons, Richards and Westons could be condemned to the kitchen and be compelled to cook our meals, kitchen methods and utensils would be soon completely revolutionized, reminds me of my experience.

Being at leisure for a time recently, I rashly volunteered to assist in a certain Monday morning household operation, by turning a crank attached to a small washing machine. This had been done by others in the house for a long time without attracting any particular attention from me, but one Monday morning's experience with it was sufficient to set me thinking, and before the next Monday morning came around I had a small water motor made which I attached to the water cock over the kitchen sink,

and by a belt from this motor to the washing machine permitted the pumping engines at the water-works to turn the crank for me; and I really suppose it is true, as Mr. Redfield intimates, that if those who are capable of inventing were obliged to do a little more household work, improvements in that branch of human industry would be more rapid and a great deal of drudgery would be avoided. C. Y. M.

▲ ▲ ▲

## "Paying Wages by Checks."

Editor American Machinist:

With some men anything of the nature of an innovation is of itself objectionable. It seems to me that, aside from this, there can be few objections raised against the check system of paying wages which will not vanish as soon as workmen become as familiar with it as they are with the present clumsy method.

Perhaps the most plausible objection is the first one raised by your correspondent, Wm. Newton, in your issue of May 28th, which is, that banks are closed at the hours when mechanics have their leisure. However, when checks are made payable to bearer, I see no reason why some member of the family might not be sent to cash a check as conveniently as to deposit the surplus in the bank, in the system which Mr. Newton describes.

In places where there is a Saturday half holiday, an arrangement might often be made to pay the wages the night before, if necessary, and thus the mechanics themselves be given access to the banks. The better class of mechanics make free use of the banks at the present time, and in many cases there would be no difficulty, even though store-keepers should object to receiving the checks in lieu of change, which I know they usually prefer.

I have in mind a Western brass foundry where the piece-work system is used, and the men are paid in silver every Monday night. The workman receives his wages in a sealed envelope, and is also given a slip of waste paper on which is a statement of the jobs. For some reason, a great many mistakes are made, and the workmen usually do not find them out till they get home and open the envelopes. Then if the bill and silver don't agree, an investigation is necessary to find out which is right. As a result, both are sometimes found to be wrong; and I have known workmen to be obliged to wait three weeks before receiving their full pay. Were the check system used, the workman could see at a glance what he has received and what he is given credit for; there would be no loose change to count and lose, and mistakes might be more easily corrected.

SPIRAL.

▲ ▲ ▲

Editor American Machinist:

To one who lives in the mill district of a large city, the fallacy, and even the criminality, of paying by check, or in bills of large denomination, is made painfully evident every pay-day.

It is the custom in the rolling mills to pay to one man the contract price for work performed—rolling, shearing or some similar operation. This contract price is divided and paid to the numerous hands employed in these operations.

It is a very simple plan so far as the office is concerned. The pay-master simply puts two or three hundred-dollar bills in an envelope, and leaves the hands to divide it up as best they can.

That is also a simple matter. The boss and his gang adjourn to the nearest saloon, and the "obliging" saloonist immediately demolishes the large bills at a very modest discount—the profit on a drink for the crowd, the bills being given in payment. The saloons make provision for this demand for small bills. Making large bills smaller is right in their line of business, since the new license law does not allow them to make small bills larger by giving credit.

In the event of payment by check it would be just the same. No bank would establish branches at all the mills and factories in the city without charging a "modest" discount for cashing checks.

No doubt, the better sort of men would gladly pay this discount to the bank rather than go to the saloons; but there is no reason why this tax should be put on the workman just to simplify matters in the office.

There are many schemes to introduce the banking idea to the working people, and payment by check does not seem to be one of the best. W. A. D.

Pittsburg, Pa.

▲ ▲ ▲

## A Cheap and Handy Boring Tool.

Editor American Machinist:

The accompanying illustration shows an excellent device for simplifying the making of tools for ordinary boring and turning with small or medium-sized engine lathes. Its advantage cannot but be apparent to one who has been accustomed to the repair and making of the ordinary rectangular shank tool, where a round stub (especially on boring tools) is necessarily welded or drawn down.

The tool being of plain round stock, and of a diameter varying to suit the work, within the limit of the tool-post slot, can be set out to any reasonable length, within the chattering limit, thus saving the time and expense of making a new tool, which in ordinary practice would have to be done, that the tool shank might come within the dimension of the tool-post slot. The question of chattering in using this class of tool and jaws might be raised, but with a tool hardened well up the shank, actual practice has shown that it will not be in excess of that of the standard and rectangular shanked tool.

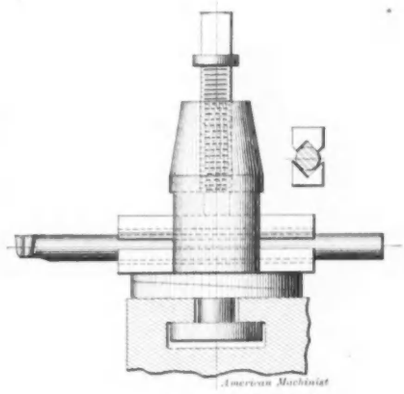
The use of these jaws and tools may not be a new idea, but they are seldom used in common practice, and to one who has been subject to the annoyance of making a new tool, or chasing all over the shop to find one suitable to several depths of bore, have become invaluable.

The simplicity of the tool, together with the applicability of the jaws to the standard tool-post, should certainly bring it into favor with the practical machinist.

CHAS. P. SCHWENNKER.

Schenectady, N. Y.

[The sketch furnished by our correspondent is, of course, not startlingly new, but it may still do excellent service as a reminder of a better way than that,



A HANDY BORING TOOL.

still all too common, of making boring tools by drawing down the shanks on the regular rectangular lathe tool steel. There is absolutely no excuse for, or possible justification of, the old practice. Tools made of standard round steel, and with these V's, or some equivalent device, for clamping them, are cheaper to begin with than the forged tools, after the V's are once made; the tools can be rolled and set to the best angle, both for cutting and for clearance; they can be set to just the right length for each individual job, so that they will spring as little as possible, and will carry a heavier cut than if they were too long, as the forged tool almost invariably must be.

With the V-blocks, as our correspondent leaves them, there will be a tendency, especially after some wear has taken place, to binding the shank the hardest right under the end of the binding screw, instead of at the ends of the blocks, which would be more desirable. With this in view it would be well to make the blocks as deep vertically as possible, or so that the combined height of the blocks and the shank would be nearly as great as the slot in the tool-post would admit. If the upper block were also made somewhat concave endwise, that also would insure the better binding of the tool. If the shank of the tool was slightly bent, that also would help to bind it when the V's were tightened down upon it; but this device might affect the pitch of the tool somewhat when used at different lengths. —Ed.]

## Shade Lines on Working Drawings.

Editor American Machinist:

Mr. Tecumseh Swift is in a class all by himself; I have been aware of that since I read his first communication to your highly instructive journal, and I do not write this to advertise the fact that he is unique. His name is quite sufficient for his one-of-a-kindness on the score of heredity and pre-natal influence, if it was given him by his sponsers in baptism; if he selected it as a nom-de-plume, then it is only an accentuation of his obvious segregation from the race of mankind at large.

But this is not what I was going to say. I have made a discovery. I have found out, not that Tecumseh is different—anyone can see that—but I know just exactly why and how he is different, and that's what I want to tell you about.

In your issue of June 11th Mr. Swift says: "If we see a drawing elaborately shaded, we know it is the work of a youth just out of the schools, or of a cheap draftsman without an idea of his own."

Precisely. Which is Mr. Leavitt, with the drawing of the Chelsea pumping engines now building at the De La Vergne shops; or Mr. Carman, chief draftsman at the Gates Iron Works? Are these gentlemen "boys just out of the schools," or are they "cheap draftsmen without an idea of their own"? One or the other, because they both make, or cause to be made, surface shaded drawings.

And when did photography make good correctly-shaded drawings ashamed of themselves? Never, to my knowledge.

Did Tecumseh ever try to turn the sun around? Did he ever try to turn a locomotive around? On the face of things, isn't it easier to turn the locomotive around and let the sun stand still? And if it comes to a matter of the imagination, isn't it just as easy to imagine things one way as another?

Tecumseh thought a needle couldn't have a little hole drilled lengthwise of it. I don't know where Tecumseh lives, or what he has seen; but any watchmaker can do that needle-drilling and not half try.

But I never will deny that Tecumseh Swift has seen a workman in doubt as to whether he shall measure to the inside or outside of the thick line on the drawing. No fellow with a head so dead wrong could figure a drawing right, anyway. Some of the largest shops do not desire a scale drawing to go into the works. Where is "emergent use" of the scale if all dimensions are figured? With up-and-down slop-work, such as Tecumseh appears to fully understand, half-figured and half the figures wrong, a workman may use his two-foot rule, but he should use a club on the draftsman if the boss's foot didn't get the artist out of the way before the workman could reach the drawing-room.

The one grand peculiarity about Tecumseh Swift is, that no matter how often he gets a knock-out blow he is never knocked out at all, but just turns up with a never-touched-me smile for the next round, no matter how heavy the other fellow gets in on the point of his jaw.

Now, here is where my discovery looms up. Physiologists tell us the point-of-the-chin knock-out blow is effective because of a nerve that leads from the chin to the brain. There is no such nerve in Mr. Tecumseh Swift's make-up; that is what I have found out. There is no connection between his brain and his chin. That's why he is always talking wrong, and why he can never be knocked out.

EASY WAY.

▲ ▲ ▲

Editor American Machinist:

It is not every one who could have succeeded in drawing for the readers of the "American Machinist" such a draught as is embodied in the clear amber of Professor Sweet and the sparkling effervescence of "Easy Way," and Tecumseh Swift is so far to be congratulated. The froth is rather superabundant and slops over badly; but as long as there is, as they say, "profit in the bubbles," by all means let them still roll on. They can soon be wiped up and forgotten. In the meantime, Tecumseh might "go to his tent and lie down in despair," only from what we have seen of him we may judge that he is not likely to do that, but he should at least hunt up the heaviest shade lines to be found and hide himself in their shadow for a while.

The "dark lines," as Professor Sweet rightly calls them, never do any harm and often do some good, and they cost next to nothing. In fact, I don't know of anything anywhere that does so much good so cheaply. On page 4, "American Machinist" of June 18th, there is a plan and elevation of a small stationary engine. The shade lines that are used upon it help very much to elucidate the shapes of the several parts and their relations to each other. It is very certain that no one would want the drawing if every line was of the same thickness. I do not think there is any workman who has sufficient intelligence to work to a drawing at all, who is misled or in any way bothered by the dark lines. On page 11 of the same issue of the "American Machinist" are the outlines of two solid dies that must have struck most readers at the first glance as rather peculiar. The holes in the die happen to be shaded wrong, and, instead of holes, they represent pieces projecting from the face of the die. These are supposed to be reproductions of a drawing which appeared in your issue of May 14th, but that was shaded correctly.

MORRIS FULTON.

Philadelphia, Pa.

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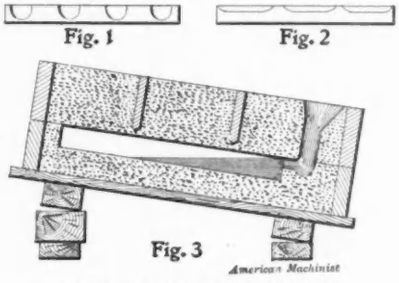
## Brass Foundry Notes.

Editor American Machinist:

I was at one time employed in a shop where they made numbers of brass slabs, used in paper-mill machinery. These slabs ranged from 10 feet to 4 feet in length, and from 12 to 24 inches in breadth, by ⅞ inch thick. When the orders first came in, we had considerable trouble from dirt in the castings, no matter how carefully molded and poured. Skim gates did not seem to help us any. At first we gated them as shown in Fig. 1, with narrow, deep gates. They were poured from the end—the long ones from each end, using two pots, the short ones at one end—and in the short ones the flasks were inclined. Experience, however, taught us to alter our gates, as shown in Fig. 2, which shows three broad, thin gates. After changing the gates we had no further trouble from dirt, as the thin gate enabled us to keep one sprue full when pouring, which is highly important where clean castings are desired; we had our metal at a medium temperature, neither very hot or very cold.

As our sand was of a coarse grade, we found that the castings were much improved by using a facing composed of equal parts new and old sand, and added to every twenty parts of this mixture one part flour, and all mixed thoroughly. This facing is also excellent on the bearings of boxes, driving brasses, etc., and anywhere where there is danger of the mold "scabbing;" also on thin work, such as name-plates, where a nice smooth surface is desirable.




POURING BRASS CASTINGS.

While mentioning slabs, I remember a heavy slab, or gib, which we used to run in rather a peculiar manner, and with great success. This gib was about 2 feet in length, 8 inches broad and 3 inches thick. We used a large sprue and poured directly into it; but, if preferred, the heavy sprue can be used as a feeder, and a smaller sprue connected therewith, used for pouring, as explained in the article on making heavy brass castings, in the "American Machinist" of March 12th. We used one square-filleted gate, at the end, and in pouring the mold was inclined towards the sprue, so that the metal had to run up hill. The flask was placed on two 2-inch strips, so as to rest level, and upon the rear strip was placed a 4-inch strip, so that the flask had an inclination of 4 inches, the sprue being at the lowest end. After pouring, the two rear strips were removed. The inclination of the mold

was thus reversed, so that the sprue was at the higher end, and there was a fall of 2 inches. This was done quickly, and generally the metal in the sprue sank down, and it was refilled from the waiting pot, which completed the job.

The advantage of having the mold inclined in this manner was, that in pouring, the metal was dropping into metal, and the mold was evenly filled; also, there was no danger of the mold drawing air, even if the sprue was not kept full. (See Fig. 3.)

Another job, different from the above, but which gave us quite enough trouble until we got it down fine, was an order for a number of brass molds, for making white metal trimmings for coffins. These molds were unusually heavy, being about 1½ inches in thickness. They were small, of course, ranging from 2 x 2 inches in size to 8 x 4 inches. There was a heavy, straight handle cast on the back, necessitating the use of a high flask, and consequently a high sprue. Now, as these castings were to be used as molds, they had to be perfect, as very little finishing could be done on them, the face of the patterns being, of course, sunken, and carved out into delicate floral and animal designs, with fancy lettering. At first we tried all new sand, sifted through a hair sieve onto the face of the pattern. The impression was carefully sprayed with molasses water and skin-dried with a hot plate. If the castings had been thin, this would have given good results; but with this weight of metal, there was always a wash somewhere. Finally we made a facing as follows, and never lost a casting: The beams and shelves of the shop were covered with dust. This dust was composed of the finer particles of sand, carried into the atmosphere by the steam when we watered our sand. As the shop was a large one, there was a large quantity of this dust; we called it "beam dust." This was gathered, and mixed with equal parts finely-sifted new sand, to every twenty parts of this mixture adding one of flour, and wetting down with stale beer or weak molasses water colored with fire-clay. Carefully spray the impressions with molasses water and skin dry. On no account dust flour on the face of these molds, as the fine impressions will be blurred. This mixture made castings as smooth as velvet. If the beam dust cannot be procured, use the dried old sand from the floor, where it has been well trodden; sift through a hair sieve. In pouring, have the metal very cool.

C. VICKERS.

Chicago, Ill.

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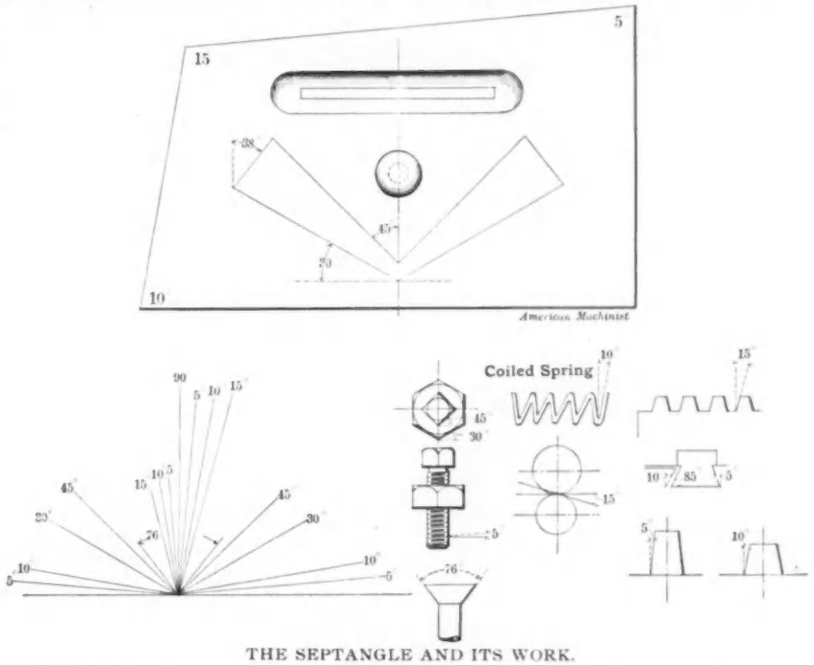
## A Septangle.

Editor American Machinist:

The interest in draftsmen's appliances, lately manifested through the "American Machinist," no doubt aroused many who have had ideas for improving the efficiency of the service, but who are doubtless too tired, rather than too unsympathetic to show them up.

The possession of three different sizes of claw hammers was once regarded by the writer as a piece of extravagance for carpenters. He has since learned, however, that where much work of a certain class is to be done, it pays to have a tool well adapted in size, weight and shape. Be it also observed, that although the claw hammer is a combination tool, no one has ever said much against it, notwithstanding it has often given temporary offense. It was not until after somebody began to put claws in the handles of hammers that people began to dislike combination tools.

The device here presented grew out of a suggestion for an erasing stencil, viz., that the erasing slot should be in a thick piece of celluloid, with edges recessed, and provided with a knob. Although the impracticability of this was pointed out by the writer, with various reasons, its utility is now gratefully acknowledged to Mr. C. H. MacClellan, of the Winchester Arms Co. The outside angles were added, and afterwards the inside ruling edges, for drawing square and hexagon nuts; also countersunk rivets and heads of wood screws. The outside ruling edges are convenient for right-angle work, tapers on hubs, screw threads, coiled springs, involute rack or worm teeth, die block dovetails, etc. The cut shows various angles and specimens that can be drawn with it. It is provided with a knob, and should be not more than 5 x 3 inches for ordinary work.




THE SEPTANGLE AND ITS WORK.

J. D. KELSEY.

New Haven, Conn.

▲ ▲ ▲

The standard hight for stokers in the British Navy has been reduced from 5 feet 5 inches to 5 feet 3 inches.

A London paper reports that it is no longer considered proper by the smart set of that city to be seen riding bicycles in public, and the reason given for this abandonment of the wheel by the "upper ten" is the usual one, that it has now become too common, and that the wives and daughters of tradesmen are making use of the wheel. Of course, few people expected that the exclusive set would long continue to ride the wheel; and it may be expected that when it is abandoned by this class of people in London, it will soon also be abandoned by those who consider themselves in the same class in this country, though that will have no serious effect upon the demand for wheels.

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We noted a couple of weeks ago that the Big Four Railway is to have sixty of its locomotives changed to compound engines by the Richmond Locomotive Works. A ten-wheel engine (No. 140 of the Chesapeake & Ohio Railroad) was compounded in the fall of 1892, and in three years, running continuously without extra cost, it is reported to have saved 1,580 tons of coal, or 22 per cent., as compared with simple engines. It was the success of this test that determined the change.

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The largest boat ever built in Michigan, the "Senator," was launched from the Wyandotte yards of the Detroit Dry Dock Company on the 20th ult. She was built for the Wolverine Steamship Company, of Detroit, and cost $260,000. She is 420 feet over all, 400 feet keel, 45 feet 6 inches beam, and 28 feet deep. She is expected to carry 4,300 gross tons and is about 15 feet draught.

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## The Business Side of Special Fixtures.

A great deal has been said and written about special fixtures from a mechanical standpoint, but very little from a business standpoint. Such fixtures are designed for two purposes—to secure interchangeability and to reduce cost. Very often interchangeability is itself a source of further saving in fitting and assembling, so that in many cases the two purposes cannot be separated.

Nevertheless, the reduced cost is often the only purpose of such appliances, and the relation between the cost of the fixture and the saving it effects is the all-important question. Where interchangeability is essential, the fixture may be designed to accomplish it without much regard to its cost; but where the saving of labor is the motive, the cost of the fixture is of first importance.

Where production is large, the saving due to a special rig is repeated so many times that almost any reasonable outlay is justifiable to secure a small saving on each piece made. We recently heard of a large corporation which was making great efforts to reduce the cost of a single small piece by one cent each. This piece is produced in such large quantities that that saving on each one would amount to an aggregate of ten thousand dollars per year, and almost any conceivable outlay which would accomplish the saving would be well justified. With some other article produced in limited quantities, this would obviously not hold, and in such a case the cost of the fixtures must be balanced against their saving. In this respect, like many others, a higher order of ability and better judgment may be required to conduct a small business than a large one.

Where the production is limited, the mechanic in charge must keep the sharpest possible watch upon himself in this matter. This kind of work is so attractive that, unless the one in charge constantly asks himself the hard, cold question, "Will this thing pay?" his heart will simply run away with his head and someone else will have the bills to pay. We know it is rank heresy to say it to a mechanical audience, but we believe that in such cases underdoing is better than overdoing, and of the two, the old fogy is a safer guide than the enthusiast. The old fogy will simply leave undone those things which he ought to have done, but the enthusiast will deliberately do those things which he ought not to do, and, of the two, the latter is the greater sin. Enthusiasm, in fact, has no proper place in a superintendent's make-up. The only standpoint from which these questions should be regarded is that of cold, hard-headed judgment.

A friend of ours, who has had some experience in these matters and who owns to having made some mistakes, was led to search for some guiding principle for this kind of work, and, as a result, formulated a general rule for his line of work, which is as follows:

The estimated saving from a given fixture must recoup the estimated outlay in making it in one year's time or less; otherwise the proposed fixture had best not be made.

This rule may seem very drastic, but we are satisfied it is not too much so. Please note that it compares the estimated cost and saving, as must be the case when the fixture is under contemplation. Sometimes, if not often, these things cost more than they are expected to, and sometimes they save less; once in a while, after long effort and heavy expense, a dismal failure must be acknowledged. Furthermore, one never knows when some measly change or improvement will be made in the product, which will lay an elegant lot of fixtures on the scrap heap—and these things make good scrap. Now, the successes must carry the failures and the superseded fixtures.

Of course, circumstances differ in different lines of business, and no fixed rule will apply to all. The nature, and especially the stability, of the business in question must have an influence on the time limit set, but in its form the rule given is perfectly general in its application and applies equally well to a large or a small business.

That this line of work is often overdone, and that the tendency of those with shop experience only is to overdo it, there can be no doubt. If some such rule as the one suggested above could be kept constantly in the mind, there is no doubt that many expensive mistakes would be avoided, and a good deal of difficulty between mechanics holding responsible positions and other men holding the cash-box would be obviated.

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## Order Steel Specially for the Purpose.

If steel manufacturers could in every case come into personal contact with their customers, and could always know the exact conditions under which a given bar of steel is to be used, there is no doubt that this would result in a saving of many thousands of dollars by steel users and a much more satisfactory condition of affairs generally.

An instance of this occurred the other day when a man entered the warehouse of a steel concern and proposed to buy a bar of steel from stock. In conversation with him it was brought out that he intended to use this steel for swaging dies; that is, dies for an operation similar to that which is performed in the Goodyear and Dayton swaging machines. He was informed that this bar of steel which he proposed to buy would probably make such dies that would run in the machine an average of about eight hours each, whereas a bar of steel might be furnished him of the same quality and at the same price, but with its carbon adapted to the particular service required, which bar would make dies that would run an average of eight to ten days on such work, and, of course, the proper steel was ordered.

It cannot be too often impressed upon steel users that when they buy bars of steel in the open market they are buying steel which is usually adapted to the average or usual purpose for which bars of that shape and size are used, and that if tools are made of such a bar that are to be used for an entirely different purpose, then the chances are overwhelmingly against such tools being satisfactory; and in every case where it is possible, steel should be obtained for the specific purpose for which it is to be used, and if toolmakers and machinists generally understood this and acted upon it, there would certainly be far less trouble with steel.

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## Our Bicycle Series.

A somewhat peculiar trait of the human mind manifests itself with regard to the publication of continued articles in such a paper as ours. Those who are not specially interested in a given series not merely refrain from reading it, but they grow impatient at its continued appearance, and object to it much more, apparently, than they would object to the publication of an equal amount of, to them, equally uninteresting matter on a

variety of subjects instead of one subject. For our part, we know that quite a large proportion of our readers are now connected with bicycle manufacturing, particularly as tool-makers, draftsmen, foremen, superintendents and proprietors. We know that these men are greatly interested in the bicycle series, and that many of them are getting information from it that would be difficult if not impossible to get in any other way; and those best competent to judge consider it a remarkable and exceedingly valuable series.

Take the present installment, for instance; it is readable by itself, without regard to what has preceded it or what may follow, and presents a full and very interesting account of a manufacturing operation that ought to interest everyone who takes any interest in mechanical operations, even though he does not now, nor expect ever to have anything to do with the manufacture of bicycles.

Very many valuable hints have been and will yet be given in this series—hints that may be applied in other than bicycle factories, and no one who wishes to be well informed regarding his business should fail to read the articles, which will be brought to a close as soon as the ground is thoroughly covered, and not before.

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Naval Constructor Theodore D. Wilson, of the Charlestown Navy Yard, died suddenly by a stroke of apoplexy on the 29th ult. Mr. Wilson was born in Brooklyn in 1840. He served an apprenticeship as shipwright in the Brooklyn Navy Yard, and was a carpenter in the navy, serving in the "Cambridge," of the North Atlantic blockading squadron, from 1861 to 1863. In December of 1863 he took charge of the building, repairing and alteration of vessels at the New York Navy Yard, was appointed Assistant Naval Constructor in 1866, and Naval Constructor in 1873, becoming Chief Constructor in 1882. His book entitled "Shipbuilding, Theoretical and Practical," is the textbook used in the United States Naval Academy, and he had charge of the work on many of the vessels of the new navy.

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On the steamship "St. Paul," which sailed from this port on the 1st inst., representatives of various American industries sailed for South America via England. The members of the party are W. T. Adams, Samuel E. Bacon, Geo. Welton Fishback, Henry R. Gilbert, William Harper, Henry D. Johnson, John A. Johnson, J. R. Kilbourne, Mr. O. Maxon, T. D. Palmer, J. M. Studebaker, Frederick Stearns and F. L. Wagar. These gentlemen go with the intention of investigating the commercial relation between this country and South America, with a view to improvement if possible. The excursion is organized under the auspices of the National Association of Manufacturers, and is under the guidance of Mr. Fishback, who is Secretary of the American Legation at Buenos Ayres.

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The American-built vessels "St. Louis" and "St. Paul" are beginning to give an excellent account of themselves, and are doing their share toward the making of new transatlantic records. The "St. Paul" especially has done remarkably well, and has out-classed the "Paris" and "New York," with which vessels she more nearly compares in respect of size and power than with others, and recently it was shown that the "St. Paul" did better than the "Lucania," considering the difference in power and size of the two vessels, the "Lucania" having fifty per cent. more power than the "St. Paul."

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# Questions and Answers.

**Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.**

(128) R. C., Odgensburg, N. Y., asks: In increasing the gear of a bicycle from 63 to 72, would you advise increasing the number of teeth on the large sprocket, or decreasing the number on the small sprocket? A.—It would depend somewhat upon circumstances. We do not believe in very small sprocket wheels, and would not put less than nine teeth in the smaller one. Large sprockets cause less stress on chain and bearings and are better generally.

(129) G. S. R. asks: 1. In drilling brass rod in the screw machine, why does drill cut better with lip sharpened as when drilling iron? A.—We suppose it is because the rake of the cutting edge tends to draw the drill in, so that less force is required to feed it and the drill cuts more freely. 2. Do you recommend the International Correspondence School, of Scranton, Pa.? A.—We do. 3. Having been educated outside, are there any schools or colleges that will let you take their graduating examinations, and if so, under what conditions? A.—We do not know of any.

(130) K., Denver, Col., writes: I have a special reamer to make which is to have twelve flutes; each flute has to be deeper than the preceding one, until the seventh, which is the same depth as the first, and so on; each opposite tooth is to be the same depth, and the tops of each tooth are to be the same width. Kindly explain how to set the milling machine to cut reamer correctly. A.—You do not say what kind of a machine you have for doing the work, but assuming that it is a universal machine, set the index for dividing twelve flutes in the ordinary manner and move the outer pin as usual. Make a trial cut for the first flute, and then revolve the reamer half way around and make a similar trial cut. Then push in the pin that holds the plate, and move the plate four holes in the same direction as when indexing. Then index for the next flute and make a trial cut, observing the depth, to give about the right amount of "land." Again turn the reamer half way around and make a similar cut. Before indexing for the next pair of flutes, turn the plate as before two holes, and for the next pair one hole. Then for the next pair turn the plate back one hole, then two holes, and then four holes for the last cuts. The depth of cutter must be varied to give proper width on top. The movement may be varied in amount; but the method is simply to give the reamer more than its regular movement for one-fourth a revolution, and then correspondingly less for the next fourth of a revolution, so that the teeth gradually decrease in pitch half-way around. Where there is only one pin the same result can be reached by regularly increasing and then decreasing the movement as the indexing proceeds.

(131) Air Compressor, Mt. Carmel, Pa., asks: Would it have any effect upon the capacity of an air cylinder if the piston, instead of working very close at each end, should have a clearance of, say, 1 inch on a cylinder 14 inches diameter, and, if so, what would be the effect? Say that I have an air compressor with 16-inch steam cylinder and 14-inch air cylinder, 18-inch stroke, and carry an air pressure of 80 pounds, all other things remaining the same, will increasing the clearance have any material effect? A.—Increasing the clearance would certainly have an effect, and the effect would be bad. In an air compressor it is always desirable to have as little clearance as possible in the compressing cylinder at the end of the stroke, because after compressing the air the work is not completed unless the air is actually delivered into the receiver. What is not delivered merely re-expands, and so far as that portion of the contents is concerned the work of compression must all be done over again. With 18-inch stroke and 1-inch clearance when compressing to 80 pounds gage pressure, or, say 6⅓ atmospheres, the air upon re-expanding down to 1 atmosphere again, on the return stroke of the piston, would only reach atmospheric pressure after the piston had traveled about 6 inches, or one-third of its stroke; so that one-third of the length of the stroke would be filled with this old air, and only two-thirds of the stroke would be filled with new air taken in from the outside. The 1-inch clearance would practically take away about one-third of the compressing capacity of the cylinder. The loss in power would not correspond with this loss in capacity, because the air in expanding would re-exert the force which had been employed in compressing it, and to that extent would be helping to drive the machine.

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# Business Specials.

**Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.**

Grant Gear Works removed to Boston—See p. 26.

1896 Catalog just out. Boston Gear Works.

Forming Lathes, Mer. Mach. Tool Co., Meriden, C.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Honest Mach. Oils. F.S. Pease Oil Co., Buffalo, N.Y.

Engine Castings ½ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Aluminum and Brass Castings, Machinery Name Plates. Twining Campbell, Paterson, N. J.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Duplex and special gear cutters, counterbores, cutter and surface grinders, vertical millers, hand punches and shears. R. M. Clough, Tolland, Conn.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

For Sale or Rent—Foundry and Machine Shop with additional land; in good condition and well equipped for medium heavy work. Capacity of foundry, seven tons per day. Located on railroad within eight miles of New York. Terms easy. Call or address, Room 41, 22 William st., N. Y.

## A Big Boiler.

Quite an astonishing sight, even to metropolitan eyes, was a mammoth boiler lately hauled through the streets of New York. The boiler was from the works of the Edgar Boiler Company, Warren, Pa., and consigned to the New York Steam Company. Our readers may imagine, if they can, a tubular cylindrical boiler, 10 feet diameter, 23 feet long, weighing 119,000 pounds (59½ tons), mounted on a wagon with wheel rims and tires about a foot wide and drawn by 36 horses. The boiler is, after all, just a plain vertical tubular boiler, guaranteed to develop 1,000 horse-power. The heads, each a single sheet, and the shell, are of steel ¾ inch thick. The shell is in three courses, each course made of two sheets, butt-riveted with four rows of rivets. There are 220 5-inch tubes, the whole heating surface amounting to 6,000 square feet of water and 600 square feet of steam-heating. Each tube is surrounded by a 7-inch circulating tube from near the bottom head up to the water line. The boiler is said to have cost $14,000.

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## Power Required for Self-Propelled Vehicles.

Sir David Salomons contributes to "The Engineer" an article on the above subject, in which, after stating his conception of the problem to be solved, and that his estimates are based upon experiments made by himself, he says:

"I assume the carriage to weigh 2½ tons when laden; then, on a good level road a speed of 7½ miles per hour can be obtained for 2⅓ horse-power, and on a bad level road for 4⅓ horse-power. To travel up an incline of 1 in 20 on a good road at the same speed would require 10 horse-power, and on an incline of 1 in 10 on a similar road about 19 horse-power would be necessary. It will be noticed from these figures that each succeeding horse-power necessary is practically double the preceding one. It will also be observed that the increased power required between a level rough road and an incline of 10 per cent., which is not uncommon in many districts, is practically as 1 to 15.

"From these figures it is obvious that in order to travel at so slow a speed as 7½ miles per hour, whether on the level or a hill of 10 per cent. rise, in the case of a carriage weighing 2½ tons, when provisioned and laden, the vehicle must carry an engine capable of giving up to, say, 20 horse-power. If a speed of 12½ miles per hour on a good road is sought, nearly 4 horse-power is necessary; on a bad road, 7⅓ horse-power; on a 1 in 20 incline, 16⅔ horse-power; on a 10 per cent. incline, roughly, 30 horse-power. For a speed throughout at the rate of 15½ miles per hour on a good level road about 5 horse-power is necessary; on a bad road, 9 horse-power; on an incline of 1 in 20, 20 horse-power; and for an incline of 10 per cent. rise, nearly 40 horse-power.

"If the weight of the vehicle laden was, say, one ton, the horse-power necessary for similar speeds would be two-fifths of the figures given above. This I mention, because one ton is approximately the weight of most petroleum motor-driven carriages when laden.

"If it now be desired to travel on the level and up hill at an unvarying speed of, say, twelve miles per hour, which speed would hold good for down hill also, since a greater speed would probably not be tolerated, it would appear, when it is taken into consideration that except in a few districts the roads are rarely what may be termed good in the strict sense of the word, such a carriage should carry an engine capable of giving from 2 horse-power up to 12 horse-power. Since the majority of the carriages in question are fitted with engines incapable of giving more than 4 horse-power, the desired uniform speed of twelve miles per hour will, therefore, be reduced to one-third, viz., four miles per hour where a 10 per cent. incline is reached. This is what they realize in practce, and may be taken as a very good proof that the figures I quote are approximately correct.

"The general analysis given above is instructive, for the reason that it teaches two important facts which are essential when a given average of speed is required: (1) That no vehicle is of much service for heavy work unless an engine capable of giving out not less than 30-horse-power is fitted; (2) that for light traffic the engine should give not less than 12 horse-power for the maximum. * * * *

"I therefore conclude, in the present state of our knowledge, that if the light petroleum-driven carriage is required to run at an average speed of twelve miles per hour on good and bad roads, where inclines exist up to a 10 per cent. rise, the carriage laden will probably weigh not less than 1½ tons and require a maximum of not less than 18 to 20 horse-power."

This is far more power than is generally considered necessary, and we think it will be found that relatively few buyers of such vehicles will not be willing to sacrifice some speed in ascending hills rather than pay for and operate engines of the capacities mentioned.

While it is important for those who propose to design or build auto-vehicles to know how much power they must carry for a given speed performance, we do not think the cost of power alone will be the controlling feature of them, since it seems probable that the total cost of operation will in any event fall far below the cost of present propelling power of road vehicles, and reliability and simplicity are apt to count for much more than almost anything else. They must be as simple as a gasoline stove, but need not be much more so.

## The Springfield Industrial Institute.

A new addition to the rapidly increasing list of trade schools is the above-named institution, located at Springfield, Mass. The institute is, however, much more than a trade school, having also engineering, academic and kindergarten training departments. In the trade-school department, instruction is given in the machinist's, pattern-maker's, plumber's, mason's, carpenter's and joiner's trades. The institute has an excellent building and is well equipped for its work, the department of more special interest to our readers having a shop 100 x 50 feet, equipped with twenty-nine engine lathes, together with speed lathes, drill presses, universal milling machine, shaper, turret lathe, planer, etc.

The course of instruction occupies one year's time, the fee for it being fifty dollars. The plan of the school embodies some new features, the chief of which is an attempt to make it self-sustaining. It has no endowment and exists on borrowed capital, on which it expects to pay interest as well as running expenses. Its sources of revenue are rentals of a portion of its property, students' fees and the sale of its products. To carry out this idea a force of workmen is kept in addition to the instructors and students. The school takes in outside or contract work in both machine and pattern shops, having recently completed ten Duryea motor carriages. The force of workmen comprises not only skilled mechanics as a foundation for the commercial work, but cheaper men as well for the commoner classes of work, the idea being to so arrange matters that the student can be given work best adapted to his state of progress, and at the same time have the shop not dependent upon his labors for its output.

The student is first given work upon practice pieces on the exercise plan, in order to give him familiarity with the tools and their operations. As he acquires this familiarity he is put at work on the commercial products, the two classes of work being alternated according to the work available and the student's progress. In the pattern shop this plan is modified somewhat. A single pattern will, of course, often call for a much wider acquaintance with the pattern-maker's trade than a single machine part will of the machinist's trade, and it is consequently found necessary to complete the series of exercises in pattern-making before beginning commercial work. The students in the machine shop are also given exercise work at the forge, after which each student dresses and tempers his own lathe and planer tools.

In order to make the commercial feature a success, the students are required to devote nine hours per day, six days per week, to the shop. That peculiar privilege of the teacher, the long summer vacation, is also abrogated, and the shop is run con-

tinuously throughout the year, except for two weeks in the summer and four days at Christmas. In this way the work done in the year's course is about equal to that done in many schools operating on the old plan in two years. The time of the boys is also economized, and they are brought down to the business nature of work at once.

This attempt to establish a self-sustaining trade school is of great interest, and is being keenly watched by educators in this field of work. The school commenced operations last November; and while the experience is short, the indications are, we are informed, that the plan outlined will be successful.

The institute is in the hands of Mr. L. B. Strong as director, who is a graduate of the Worcester Polytechnic Institute, from which the method of conducting the shop is largely copied. The institute owes its organization to Rev. D. A. Reed, who has had considerable and successful experience in organizing self-supporting schools, though not before in this field of work.

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## The Efficiencies of Air Compressors.

BY C. P. PAULDING.

Having read with great interest the articles on tests of air compressors that have lately appeared in the "American Machinist," I beg leave to take up a few points in them.

essary to compress the given volume of air to the given pressure, and then to expel it from the compressing cylinder against that pressure. This definition of useful work is fulfilled by isothermal compression combined with entire absence of valve resistance, and in consequence the efficiency of a compressor may be very readily calculated from an indicator card.

In the card shown in the figure the actual area is assumed to be 2½ square inches, and the card *O P M N*, representing the useful work done, is assumed to have an area of 2 square inches. The efficiency would then be $\frac{2.}{2.5}$, which equals 80 per cent. The card *O P M N* is constructed thus: *O P* evidently represents the volume of free air compressed and delivered per stroke, *O N* is an isothermal curve constructed with *M P* as the line of no volume, and the area *O P M N* therefore represents the least possible work of compression and delivery. It is not, however, necessary to construct this ideal card; its area can be calculated as follows:

Area $O\ P\ M\ N = O\ P \times Pa$ (hyperbolic $\log \frac{Pd}{Pa}$) The length $O\ P$ and the heights $Pd$ and $Pa$ are to be measured in inches from the card.

It has been shown by various tests of air compressors, by Professor Riedler, that the results obtained by the above

cubic feet of air compressed per revolution:

Indicated horse-power of steam cylinders, 351.64;

Indicated horse-power of air cylinders. 286.75;

$$\text{Efficiency of mechanism} = \frac{286.75}{351.64} = 81.5$$

per cent.;

Useful work done in air cylinders, horse-power, 226.10;

$$\text{Efficiency of compression} = \frac{226.10}{286.75} = 78.9$$

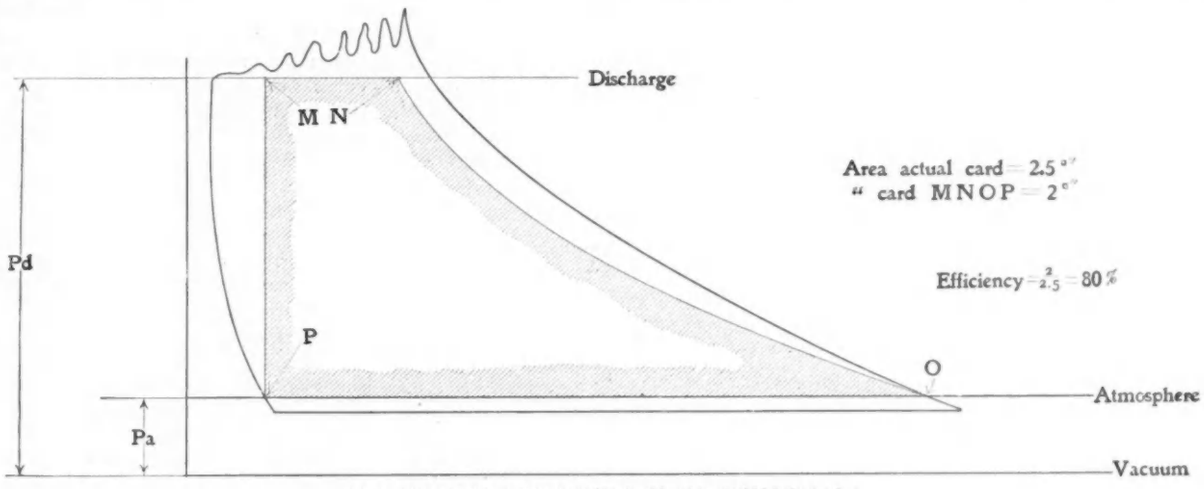
per cent.:

Efficiency of the whole machine = 81.5 × 78.9 = 64.4 per cent.

It will be remembered that this was a case of three-stage compression to 2,000 pounds pressure.

The "American Machinist" of April 16, 1896, affords an example of two-stage compression to 60 pounds pressure, and a measurement of the printed cards on page 405 shows an average efficiency of 74½ per cent. This figure must, of course, be taken as only approximate. This is, however, a very poor showing compared to the 89 per cent. obtained by the Riedler two-stage compressors, in Paris, compressing to 90 pounds absolute.

Turning to single-stage compression, the most interesting efficiencies would be those of compressors such as the Rand or Ingersoll-Sergeant. Not possessing this information, it may be of some interest to




THE POSSIBLE AND ACTUAL IN AIR COMPRESSORS.

In tests of any machine of a class it is always desirable to have some figure given, such as, for example, the efficiency, by which the performance of that machine may be compared with that of others of the same class. Now, as a general rule, and in the articles referred to above, no such figure is given. The object of this letter is to point out how easily it may be obtained.

The efficiency of any machine is the ratio of the actual work done to the useful work done. In the case of the air compressor, the "useful work" is best taken to signify the least work theoretically nec-

method from a few indicator cards agree sufficiently well for most practical purposes with the results of extended tests. As air compressors are usually driven by steam engines, an analysis of the whole machine, very complete for practical purposes, may be obtained by taking cards from the steam cylinders as well as the air cylinders.

The compressors at Fort Scott, described in your issue of April 23, 1896, furnish a very interesting example. The following figures are all taken from that description, the "useful work" being calculated in this case from the figure as 6.97

know that of a number of the best single-stage compressors tested about 1890, the best efficiencies were between 70 and 73½ per cent. when compressing to about 90 pounds absolute. In Richards' "Compressed Air" is a diagram which Mr. Richards says "is the best and most satisfactory diagram made by a single compression that I have ever seen." This diagram, measured from the printed page, shows the remarkably high efficiency of 82 per cent.

From the above it will be seen that, by the aid of compressing the air in several cylinders and cooling it between, we can

now compress air to 2,000 pounds with as great economy as a few years ago we could compress it to 75 pounds. It is also hoped that these few examples show the convenience and advantage of finding the efficiency of an air compressor. It is true that it confounds the loss due to imperfect valve action with that due to imperfect cooling; but the former is very clearly shown on an indicator card, and the latter only properly shown by a computation of the co-efficient of the curve of compression—a tedious and rather unsatisfactory proceeding.

In regard to the heating of the air on admission to the cylinder, mentioned in the article on the two-stage compressor, I would like to call your attention to the fact that you published, in 1892, the graduating thesis of Messrs. Gause and Post, of the Stevens Institute. Contrary to most graduating theses, it was apparently reliable, for it is quoted several times by Prof. J. E. Denton, in his book on "Ice Machines." One quotation is as follows: "But for pressures of about 100 pounds. the experiments of Messrs. Gause and Post, of Hoboken, show that the cylinder superheating with jacket cooling reduces the displacement only about 8 per cent., when the air enters the compressing cylinder as directly as possible, through valves in the cylinder heads." As it is impossible now to procure this number of your paper, and as this subject must now be of interest to many of your readers, would it take too much of your valuable space to republish a portion of it? It also throws very valuable light on the deceptiveness of low temperatures of the air leaving a compressor, and proves that this cooling is only effected after compression is accomplished.

In conclusion, will some of your readers send in to you cards from some of the well-known single stage compressors, to fill up the gap in this attempted sketch of air compressor efficiencies? And also, will Mr. Richards give us more details of the compressor that produced the remarkable card already spoken of?

Calumet, Mich.

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## A Monster Brewery.

Some sport has been derived from the visit of the members of the A. S. M. E. to the Anheuser-Busch brewery in St. Louis, but that it is a sight worth seeing, independent of whatever other attractions there may be there, is shown by the following statistics of the establishment:

The plant covers fifty-seven acres; the employés number between 900 and 1,000; 268 Norman draught-horses and 10 roadsters for private driving are stabled here; the glass stock-rooms contain 40,000,000 bottles from the three factories of the concern, from which 25,000,000 go forth every year filled with beer; a separate railway freight depot is on the premises for storing and loading the company's own cars; 2,400,000 barrels can be stored at one time in the brewery vaults; the ice machines on the premises have a capacity for making 420 tons a day, and include one machine which is the largest ever built; the four beer-boilers can turn out 1,000 barrels an hour, and the whole concern requires 4,800 incandescent and 50 arc lamps to illumine it.

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The Providence & Stonington Steamship Co. has had plans made by Harlan & Hollingsworth, of Wilmington, Del., for a steamer which is to be in all respects superior to any of the present boats of the fleet. The new vessel will be called the "Vermont," will be 400 feet long, and will have twin screws and triple-expansion engines.

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## Business is Business.

A workman employed by a wealthy firm of manufacturers in Birmingham committed suicide. On behalf of the man's widow and child, the firm were asked to state what money was due to the deceased, but no satisfactory statement could be obtained, and ultimately a solicitor's letter was sent. To this the firm replied that the sum owing by them to the deceased was 1s. 10d., which they forwarded, less 1d. for postage.—London "Truth."

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## Explosive Vapors.

One volume of petroleum vapor renders 380 volumes of air explosive and 1,150 volumes inflammable. A red-hot piece of metal, a "live" coal or a spark from steel or flint will not ignite an explosive atmosphere of petroleum vapor; but white-hot metal, flame or an electric spark will readily do so. Naptha at 70 degrees Fahr. evaporates at the rate of about 6 pounds per square foot exposed per hour.

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A very disastrous boiler explosion took place in Houston, Tex., on the 29th ult. A small boiler in the office of the "Daily Age" exploded, killing the engineer and then flying through a brick wall of a nearby building, killed two persons in the office of the Southern Pacific Railway Co. and seriously injured two others. It is reported that the engineer was in a neighboring saloon just before the explosion, and as he left, remarked that he "must go and see to that boiler."

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Defective safety valves are most apt to result in boiler explosions, but such a valve in this city recently caused an accident that is out of the usual order. A pin in the lever broke, letting the ball off the lever, and the ball in falling struck the engineer on the head, giving him a severe scalp wound; while the opened valve filled the place with steam and caused a panic among a lot of laundry girls employed in the place.

A new labor organization was recently organized in New York City, which is called the Trades Union Alliance. It proposes to oppose strikes and to take an active part in politics instead.

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It is reported that two men in Jacksonville, Fla., have discovered a method by which dynamite, nitro-glycerine and other high explosives may be fired from an ordinary rifle.

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Nine buildings have recently been added to the Southern Railway shops at Atlanta, Ga., and it is claimed that these shops are now the largest of their kind in the South.

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Locomotives to the value of $80,883 were exported from the United Kingdom during the first five months of this year. South America took $22,197 worth of these.

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The American Watch Co.'s factory at Waltham, Mass, has shut down for the regular summer vacation and is expected to resume operations in full about August 5th.

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# Commercial Review.

NEW YORK, SATURDAY EVENING, JULY 4th.

## Engines, Boilers, etc.

It cannot be said that the engine or boiler market exhibits any strikingly new feature, nor that its present average condition illustrates anything but the oncoming of a summer resting spell, but it is apparent that a few companies can review the half year just closed with considerable complacency, and we venture the opinion that the trade in engines and boilers during this period has been in excess of that of the first six months of last year.

If at present either department of the engine and boiler market is in the lead, we are inclined to think it is boilers. While not all concerns are equally fortunate in securing trade, some few give exceptionally bright reports. One, which stands in the foremost rank, completed with July 1st the best year of its history, with no falling off of trade yet perceptible. Several consider the first five or six months of this year ahead of the corresponding time last year. Of these, one reports considerable present inquiry, though probably most companies would agree that the greater part of their orders were taken in before the latter part of June, or considerably earlier. The Edgar Boiler Company, of this city, who have been in business about six months, have sold over 7,000 horse-power of boilers since the first of February; one of them, as has already been made public, was a 1,000 horse-power boiler for the New York Steam Company. The Babcock & Wilcox Company have received

an order for 3,000 horse-power of boilers for the Solvay Process (soda ash) Company, and for 400 horse-power for the Townsend building, of this city.

A leading high-speed engine company might be cited, who have been for quite a while past inclined to consider the situation a dull one, yet have managed to secure enough work to keep them now fairly well employed, principally in filling orders that were booked some time ago. Another concern, B. W. Payne & Sons, report May and June as having been good months, though naturally business is less active at present. This firm have received an order for eight small engines for a locomotive works built in Russia with American capital. Still another company find their own business just now much improved, reporting the sale of a 400 horse-power compound engine of the Corliss type, for a compressed-air railway to be located in Washington, D. C.

Early in the year it was noticeable that a great many inquiries were floating around the engine market—many more, in fact, than the orders actually placed. We seem at present to hear less talk of the numerous inquiries. Many of those which were then on the carpet have materialized into contracts, others may have been abandoned, while still others remain to be consummated in the future. Of new buildings in this city, at least four important ones are yet to place orders for steam plants. To three of these, the new Waldorf Hotel, the Bank of Commerce and the New York Athletic Club, we called attention in our last article upon the electrical trade. The fourth is to be a tall office building, situated on Park Row, near Ann street, for which excavations are now being made.

A seller of high-speed engines remarked this week, that for those manufacturers who had been cutting prices on the same, the situation is becoming duller, while for those who had held prices, it is improving. Although our opinion may differ with this in some respects, it is well to consider whether those people who maintain their figures at a living basis have not fared best. However, the engines among which the most ruthless cutting has been done are probably those of inferior grade, or, as has been said, those whose makers are out of town concerns which desire to obtain for their goods an introduction into this market.

We publish, by way of business opinion, the following letter from the Philadelphia Engineering Works, manufacturers of Corliss engines: "We find, upon investigation, that orders received by us for engines in the month of June, 1896, are about the same as those received in May, 1895, although in June, 1895, we had booked nearly 50 per cent. more than in the same month in 1896. On the whole, we find business listless and dull, and not equal to that of the first six months of last year. It is true we booked more orders in the last half of the year than a year and a half previous, and have been exceedingly busy, working day and night until the first of February of this year, since which time our force has been reduced to the usual day turn. We are looking for a good fall business, and have every reason to believe that there will be plenty of work offering later in the year."

A steam engine company of this State, while remarking that for a good many months past they have been very busy, say that they do not find the outlook for large engines, from 500 horse-power up, very bright, and call attention to the lowness of prices and keenness of competition.

A Western company, manufacturers of steam pumps and other machinery, write us: "Business in our line has been fair during the past six months; prices have remained unchanged for this year. Trade in June shows a fair increase over May this year and also May of last year. We sell our line to all kinds of buyers and cannot state just what class are most prominent in the market. We do not believe the outlook for the next four or five months is bright. . . . The trouble with our country to-day is, we have too much politics and too little patriotism."

Armstrong Bros. Tool Co., of Chicago, dealers in machinists' supplies, etc., report that although the business of June was not first class, it was about equal to that of May, which was some 20 per cent. better than that of June, 1895. Their sales to the railroads have formed the most conspicuous branch of their trade, and have amounted to quite a little during the last few months. At present the outlook for next fall's trade is, so far as they can see, very good.

The following are two reports from machine tool companies, which were deferred from last week:

The Toledo Machine & Tool Co., makers of sheet metal tools, special bicycle machinery, etc., write: "We have been very busy right along, and are so at the present time. We have within the past month contracted for several large orders, which are going to keep us busy for some little time to come. We are also pleased to state that we have several prospective orders in view, and from present outlook we have no complaint to make whatever, as we have orders enough to keep us busy for some time to come."

The Ohio Machine Tool Co., of Kenton, O., state: "We are very, very busy, and have been since the first of the year, working more men now than ever before, and have run nights fully two-thirds of the time since January 1st. We are aware that most machine tool manufacturers in our line are not very busy at present, and cannot account for our being so, unless it is the quality of tools we build. Orders for both May and June have been coming in much more freely than the same months last year. We realize, however, that business generally is considerably depressed, but are looking for and hoping for a revival soon along all lines."

Wrought iron pipe is dull, and the price weaker, as would doubtless be more evident were some order placed, large enough to bring it out.

The iron market remains quiet. Among the metals, tin has grown firmer, and Lake Superior ingot copper has been rather weak in price.

## Quotations.

NEW YORK, Monday, July 6th.

Iron—American pig, tidewater delivery:

| | |
|---|---|
| No. 1 foundry, Northern | $12 50 @ $13 25 |
| No. 2 foundry, Northern | 12 00 @ 12 50 |
| No. 2 plain, Northern | 11 00 @ 11 50 |
| Gray Forge | 11 00 @ 11 50 |
| No. 1 foundry, Southern | 11 50 @ 12 00 |
| No. 2 foundry, Southern | 11 00 @ 11 50 |
| No. 3 foundry, Southern | 10 75 @ 11 00 |
| No. 1 soft, Southern | 11 00 @ 11 25 |
| No. 2 soft, Southern | 10 50 @ 10 75 |
| Foundry forge, Southern | 10 25 @ 10 50 |

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.10 @ 1.20c.; refined, 1.20 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11½ @ 11¾c.; electrolytic, 11⅛ @ 11¼c.; casting copper, 10¾ @ 10⅞c.

Pig Tin—For 5 and 10-ton lots, 13.60 @ 13.65c. f. o. b.

Pig Lead—In carloads, 2.97½ @ 3.02½c.

Spelter—In carload lots, New York delivery 4.00 @ 4.10c.

Antimony—Cookson's, 7.30c.; Hallett's, 6.60c.; Japanese, 6½c.

Lard Oil—Prime city, present make, 42 @ 45c., according to quantity.

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# Manufactures.

The McIntosh-Hemphill Co., Pittsburgh, Pa., will make additions to their machine shop and foundry and will put in new machinery.

The New York office of the Hyatt Roller Bearing Co., has been removed from 133 Liberty street to the Havemeyer building, 26 Cortlandt street.

The Titusville Iron Co., of Titusville, Pa., have completed their new boiler shop, which will be equipped with new boiler-making machinery.

The Dartmouth Ferry Commission, John W. Jago, secretary, Dartmouth, Nova Scotia, Canada, intend to build a new and modern ferry steamer.

A. Knowles has purchased the factory formerly occupied by the Ball Electric Light Co., at London, Ont., Canada, and will fit it up for a machine shop.

A large new foundry will be built at an early date by the Hydraulic Machinery Co., of Pittsburgh, Pa. A complete outfit of machinery will be installed.

Geo. Loeffert & Son, cor. Water and Hill streets, Allegheny, Pa., will build a large planing mill at Sharpsburg, Pa., and will equip the plant with new machinery.

The Germania Brewing Co., 1716 N. Broad street, Philadelphia, Pa., are making large additions to their brewery, and new machinery in this line will be installed.

The new Pittsburgh & Western R. R. shops will be located near Warren, O. The present shops at Painesville will be moved there, and the machinery department will be tripled.

Mr. Wm. Marsh, St. Rodis, Que., Canada, will shortly begin the erection of a new factory for the manufacture of boots and shoes. The factory will be 300 x 50 feet and 4 stories high.

Hanley & Dillon, of Erie, Pa., will move their large forging works to Titusville, Pa., to manufacture forgings for the oil well trade. They will also add considerable new machinery.

The Consumers Brewing Co., Washington, D. C., are erecting a large brewery at Rosslyn, Va., and intend to install boilers, engines, ice plant, vats, kettles, etc. Capital stock $150,000.

Sailer Mfg. Co., of Janesville, Wis., was organized and will soon begin the manufacture of their new band cutter and threshing machine feeder. Mr. Sailer will act as superintendent.

At Homestead, Pa., a new tin plate plant will be built by the John Dunlap Co. The buildings will be erected this summer, and when completed it is expected 400 will be given employment.

The New York & Cleveland Gas Coal Co., Pittsburgh, Pa., will erect a large machine shop and foundry at Turtle Creek, Pa., which will be equipped with new and improved machinery.

A new firm, known as the Hogan Mfg. Co., of Erie, Pa., has embarked in the manufacture of wire nails. They expect to be in operation by July 1st. They will install a complete line of new machinery.

Jas. M. Shackelton, of Janesville, Wis., who bought the Hodson Flour Mills of that city (two hundred and fifty barrels capacity), will soon put in a steam plant to run the mill during the low water.

The automatic press business of the Harris Automatic Press Co., of Niles, O., has increased so that the company has under way a large addition to their old plant, and will place some new machine tools.

Furnace No. 9 of the Thomas Iron Company, located at Island Park, Pa., after a run of 122 weeks has been blown out for repairs. Among other improvements a new boiler plant will be installed and the furnace relined.

A receiver has been appointed for the Falls Rivet and Machine Company, of Cuyahoga Falls, Ohio. The company's liabilities are placed at $375,000 and assets at $615,000. The company was bonded for $300,000 in 1893.

The Berlin Iron Bridge Company, of East Berlin, Conn., have secured a contract for a steel rolling mill building, 103 feet wide and 112 feet long, from the Pennsylvania Bolt and Nut Company, of Lebanon, Pa. The building will have a steel frame and roof and sides will be corrugated iron.

The Lake Harold Gold Mines Co., Ltd., is seeking incorporation under a capital of $150,000, to carry on in all its branches the business of mining, producing, milling, etc., gold, silver or other ores of metals. Harold Andrew Wiley, George Thomas Marks, Frank N. Gibbs, Frank E. Gibbs and Franklin S. Wiley, of Port Arthur, Ont., Canada, are the principals.

The Boston Gear Works, 31 Hartford street, Boston, Mass., inform us that their business has developed in a very gratifying way, and that they have recently added facilities for producing planed and correctly formed beveled gears. They are also making improved transmission chains to take the place of belts and the cruder forms of chains where positive driving is necessary.

The Davis & Egan Machine Tool Co., of Cincinnati, O., have received within the last ten days from England, orders for the following tools: Seven 22½-inch drills, four 14-inch lathes, two 16-inch lathes, one 20 x 10 lathe, one 18 x 8 lathe, one 24 x 24 x 6 planer, one No. 00 milling machine and one No. 3 Universal milling machine. Most of the above tools are to be used in bicycle factories.

Sealed proposals are being invited until July 15th for furnishing the necessary material and labor required for the complete construction and erection at the site, of a duplicate steam fog-signal apparatus for the Tibbetts Point Light Station, near Cape Vincent, N. Y. Prospective bidders desiring plans and specifications can obtain same upon application to Lieut.-Col. J. A. Smith, Cleveland, O.

The Keystone Match and Machine Co., of Lebanon, Pa., are about to embark in the manufacture of bicycles. They have secured a designer from near Boston and will be ready in a few weeks to put in the necessary machinery to turn out about 100 wheels per week. J. L. Rockey is secretary. The Standard Machine Co. is to furnish the grinding and special machinery. The balance has not been contracted for.

# Help Wanted.

**Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

**TO SUBSCRIBERS**

**whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.**

Wanted—Pos. as brass foundry foreman; good ref. as to ability and char. Box 200, AM. MACH.

Wanted—Tool maker and designer. State age, experience and salary. Ad. Box 201, AM. MACH.

Exp. mech. dftsman wants pos.; good references. Ad. Max Brauner, 65 St. Marks Place, B'klyn, N. Y.

Pos. wanted by first-class mech. dftsman.; rapid and correct workman; A 1 refs. Box 199, AM. MACH.

Wanted—Good all-round machinist wants work; used to small, accurate work; out of New York preferred; married; age 25. Box 187, AMER. MACH.

Wanted—Position as foreman or otherwise; experienced in accurate interchangeable work; used to handling men profitably. Box 198, AM. MACH.

Wanted—A position as foundry foreman; 17 yrs.' experience on jobbing and machinery work; the best of references. Address Box 192, AMER. MACH.

Wanted—Situation by blacksmith on medium heft machine forgings; used to power or steam hammer; best of references. Box 194, AM. MACH.

Wanted—First-class machine shop foreman, one with experience in wood-working machinery; married man preferred. Studebaker Bros. Mfg. Co., South Bend, Ind.

Wanted—An experienced foreman for machine shop in a Western city. One thoroughly acquainted with elevator work and hoisting machinery. Address, Box 169, care AMERICAN MACHINIST.

An all-round blacksmith wants a position; would take tool fire and agree to pay for all tools spoiled in hardening; reference if desired. Address Box 196, AMERICAN MACHINIST.

Does anybody want a mechanical draftsman; a good, practical man who can work out other people's ideas as well as his own and make things come together right? Address Box 195, AMER. MACH.

Wanted—Position by an electrical engineer, capable of designing high-grade direct current apparatus for light or power and superintending construction of same. Address Box 191, AMER. MACH.

Mech. engr. with 18 years' exp., including tech. college course, shop and office w'k, wants sit.; exp. in heavy gen. machy., water wheels, power installations, transmission machy., structural work; good draftsman; references. Box 190, AMER. MACHINIST.

Machine shop foreman wants to change; can get out work accurately, quickly, and handle men and tools to best advantage; high class specialties, engines or general machine work. Address Box 193, AMERICAN MACHINIST.

Practical mach'st with large experience and good references wanted to manage a job shop; must be familiar with the building and repairing of large and small machinery and with pattern making; accustomed to the use of drawings, and competent to direct a large force of machinists. Address Lock Box No. 47, Cambridgeport, Mass.

Up-to-date mechanical engineer, holding responsible position with large engine concern, desires to make a change; full of new ideas in the engine line; good organizer; can make profits in hard times by introducing cheap methods, push and energy. Superintendent or manager. Address Box 197, AMERICAN MACHINIST.

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# Miscellaneous Wants.

**Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

**Cheap 2d hd lathes & planers. S.M. York, Clev'd, O.**

**Calipers & Gauges. F. A. Welles, Milwaukee, Wis.**

**Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co.**

**Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.**

**For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.**

**We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co. Middletown, Ohio.**

Inventors—Patents procured, construction, drawings and inventions perfected by Wm. G. Nelson & Co., mech. engrs. & pat. attys, 108 Fulton st., N.Y.

Cheap for quick sale.—1 Wheeler Planer 42 x 42, very heavy, first-class condition; cost $1,900, will sell for $650. Butterworth & Lowe, Grand Rapids, Mich.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call or get list 17 B. The Garvin Mach. Co., 440 Canal st., N. Y.

For Sale or to Rent—A machine shop which will require, additional, a small planer and a larger lathe to make it complete for jobbing work, to take the place of a large shop fifty years standing which was burned last fall. No better location for a practical machinist with $1,000 capital. Rent $300; can be paid in work. Lock Box 6, Fultonville, N. Y.


**Valuable ...Books.**

**SHOP KINKS.**
By ROBERT GRIMSHAW.
400 pp., 222 illustrations.
Price, $2.50.

**THE MODERN MACHINIST.**
By JOHN T. USHER.
2d edition. 322 pp., 257 illustrations. Price, $2.50.

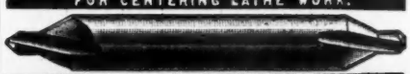
These books show by plain description, and by profuse engravings made expressly for them, all that is best, most advanced, and of the highest efficiency in modern machine shop practice. They are right up to date, and are written by men who understand the subject.

*** Copies mailed on receipt of price, or special circular sent on request.

Send for our catalogue of books for Machinists, Engineers, Electricians, and all practical subjects.

**NORMAN W. HENLEY & CO., Publishers,**
**15 Beekman Street, New York.**

**COMBINED DRILL AND COUNTERSINK**
FOR CENTERING LATHE WORK.



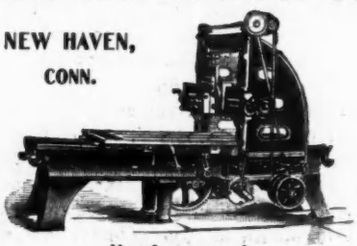
**J. T. SLOCOMB & CO.,**
PROVIDENCE, R.I. U.S.A.

**New 20-in.**
**Combination Drill,**
A most valuable machine for general use. Ask for Drill Book C.
**Sibley & Ware, S. Bend, Ind.**

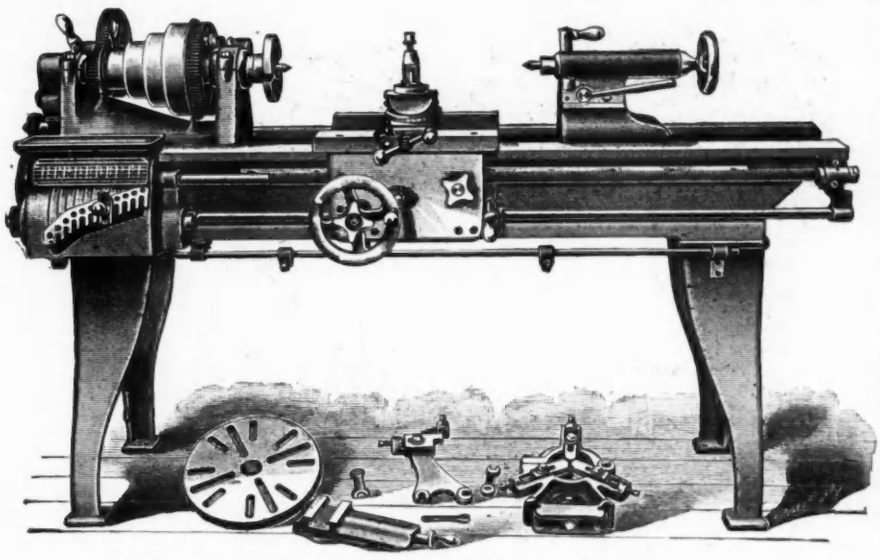
**The Toledo Machine and Tool Co.**
MANUFACTURERS OF

**Power Punching, Drop Trimming, Stamping, Riveting, Embossing Presses,**
**With Automatic Feeds.**
**MACHINES FOR WORKING BAR AND ... SHEET METALS.**
Complete Outfits for Can Making.
SEND FOR CATALOGUE A.
**The Toledo Machine and Tool Co.**
**Oak and Jackson Ave., TOLEDO, O., U. S. A.**

**NEW HAVEN MFG. CO.**
**NEW HAVEN, CONN.**



**Manufacturers of**
**IRON WORKING MACHINERY.**
**Catalogue AC.**



14 in. x 6 ft. Hendey-Norton Lathe with Improved Automatic Stop.

THIS Lathe COMBINES the LATEST and BEST Improvements. Automatic Stop. It is Simple, Durable, Indispensable. It will AUTOMATICALLY STOP the Carriage in EITHER direction. It is equally efficient whether FEEDING or THREAD-CUTTING. Running up to a shoulder, boring to BOTTOM of holes, or INTERNAL THREAD-CUTTING.

No danger of spoiling either tool or work. It is a safeguard against accidents, in either direction.

Feeds — It has all feeds in daily use with simple movement of lever.

Threads — It has all threads in daily use with simple movement of lever.

Carriage — The carriage reverses in Apron. No slamming of Countershaft. There is no comparison between this Lathe and the old style or common Lathe. Quick work, rapid changes, satisfactory results. BUY THE BEST.

SEND FOR CIRCULAR.

# The Hendey Machine Co.

## TORRINGTON, CONN.

European Agents:

CHAS. CHURCHILL & CO. (Ltd.),
21 Cross Street, Finsbury, London.

SCHUCHARDT & SCHUTTE,
59 Spandauerstrasse, Berlin.

SOLLER, Basel, Switzerland.

# New Catalogs.

**There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.**

The Lunkenheimer Co., Cincinnati, O., send us a copy of their pocket edition catalog, which contains illustrations with descriptions and points of information regarding a very large variety of valves and steam fittings of every description. It is 4 x 5¾ inches.

The Buffalo Forge Co., Buffalo, N. Y., send us a catalog illustrating Buffalo disk fans, which are applied to exhausting, ventilating and cooling. Information regarding this branch of engineering is given, with diagrams and photographs of such plants. The catalog is 6 x 5¾ inches.

W. N. Durant, Milwaukee, Wis., has issued a new catalog of counting machines, which consist of revolution counters, such as are used on engines, printing presses and other machinery. It also contains a number of fac-simile reproductions of letters written by users of these counters. The size of catalog is 5 x 7 inches.

The Bignall & Keeler Mfg. Co., of St. Louis, Mo., send us their catalog No. 13, which illustrates their Peerless pipe-threading machine in various sizes, shapers, emery surface grinders and other smaller specialities. The catalog is 4½ x 6½ inches, and will be forwarded to all who mention this paper, for which purpose communications should be sent to the factory at Edwardsville, Ill.

Browne & Sharpe Mfg. Co., Providence, R. I., have issued a very fine book containing illustrations within their works and of their exhibit of tools at Chicago. Much that is interesting will be found in the book, and its circulation should also be beneficial in an educational way. It is 9¼ x 12 inches, and is probably another instance of the bookbinder's attempt to conform to the standard.

The Snow Steam Pump Works, Buffalo, N. Y., have published an exceptionally fine book which is devoted mainly to the treatment of subjects connected with the manufacture and operation of steam pumps. It has also a good deal of other information, and is offered as a souvenir of the May meeting of the American Waterworks Association held in Indianapolis, Ind., and is an elegant specimen in every respect. It is large standard size, 9 x 12 inches.

A. P. Wagner Tool Works, Sydney, O., have issued a small catalog illustrating and describing a line of lathes made by them. These lathes conform to the standard practice, and are fully illustrated and described, along with views of the exterior and interior of the shops in which they are built. A small pamphlet is inclosed in the catalog devoted to each size of lathe. No. 1 being for an eight-inch lathe; No. 2 for a ten inch; No. 3 for a twelve-inch; No. 4 for a fourteen-inch, and No. 5 for an eighteen-inch lathe. They are standard size, 8½ x 6 inches.

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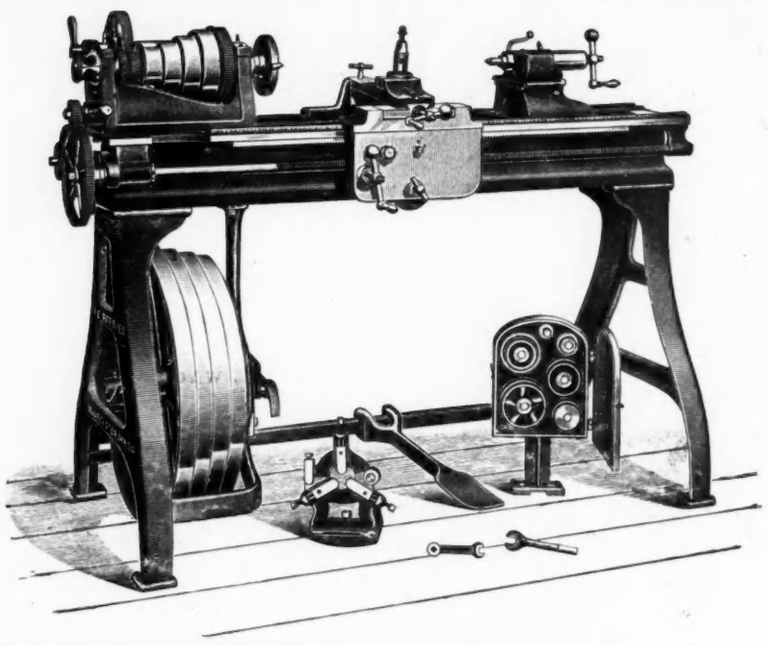

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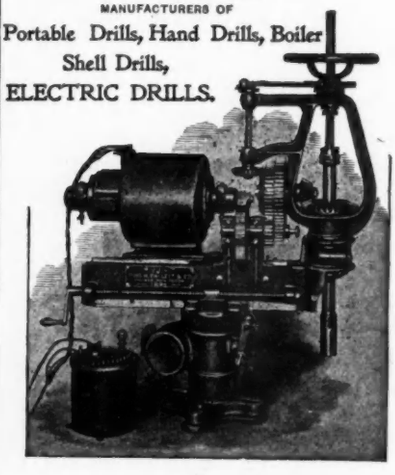

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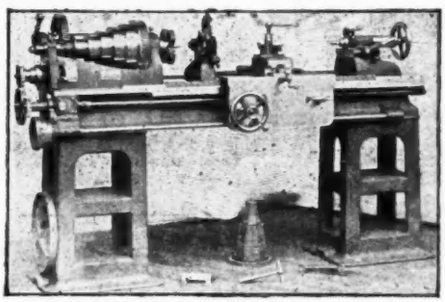

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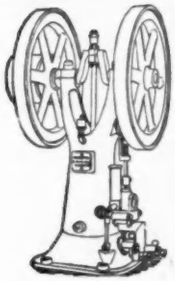

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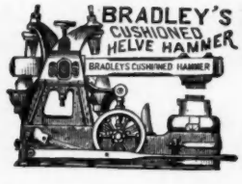


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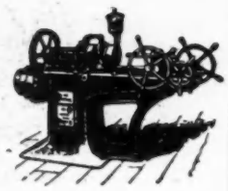

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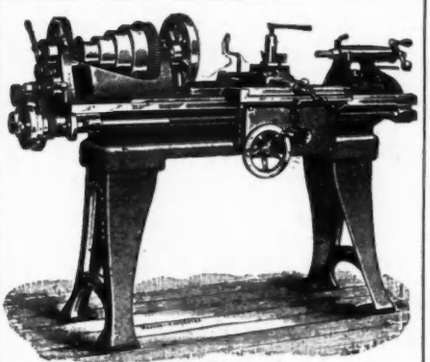

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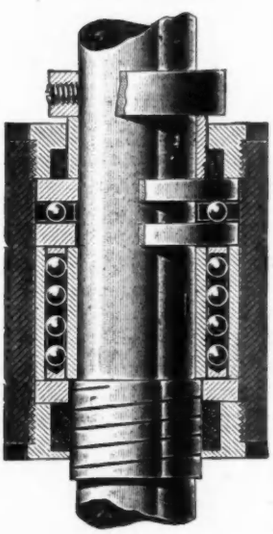

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Strelinger & Co., Chas. A., Detroit, Mich.

**Engines, Gas and Gasoline.**
Norman Co., J. J., Chicago, Ill.
Otto Gas Engine Works, Philadelphia, Pa.
Pierce Engine Co., Racine, Wis.
Springfield Gas Engine Co., Springfield, O.
Webster Manufacturing Co., Chicago, Ill.

**Engines, Steam.**
Ames Iron Works, Oswego, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
Forbes & Co., W. D., Hoboken, N. J.
Frick Co., The, Waynesboro, Pa.
Keystone Engine & Mach. Works, Phila., Pa.
Sturtevant Co., B. F., Boston, Mass.
Weston Engine Co., Painted Post, N. Y.
Wetherill Machine Co., James P., Chester, Pa.

**Feed Water Heaters and Purifiers.**
Hoppes Mfg. Co., Springfield, O.
National Pipe Bending Co., New Haven, Conn.
Taunton Locomotive Mfg. Co., Taunton, Mass.

**Files.**
Arcade File Works, New York.
Besly & Co., Chas. H., Chicago, Ill.
Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Nicholson File Co., Providence, R. I.
Strelinger & Co., Chas. A., Detroit, Mich.

*(Continued on page 28)*

BUYERS' FINDING LIST—Continued.

**Fire-proof Construction Materials.**
Johns Mfg. Co., H. W., New York.

**Forges.**
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Boston, Mass.
Wilkinson Co., The, Chicago, Ill.

**Friction Cones.**
Evans Friction Cone Co., Boston, Mass.

**Furnaces.**
American Gas Furnace Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.

**Gages.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Coffin & Leighton, Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wyke & Co., J., East Boston, Mass.

**Gauges, Pressure Recording.**
Schaffer & Budenberg, Brooklyn, N. Y.

**Gear Cutters.**
Brainard Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gould & Eberhardt, Newark, N. J.
Grant, Geo. B., Lexington, Mass.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whiton Mach. Co., D. E., New London, Conn.

**Gears.**
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Grant, Geo. B., Lexington, Mass.
New Process Raw Hide Co., Syracuse, N. Y.
Shriver & Co., T., New York.

**Governors.**
Replogle Governor Works, The, Akron, O.

**Graphite.**
Dixon Crucible Co., Joseph, Jersey City, N. J.

**Grinding and Polishing Machines.**
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders Iron Foundry, Providence, R. I.
Diamond Machine Co., Providence, R. I.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Landis Bros., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Norton Emery Wheel Co., Worcester, Mass.
Place Machine Co., George, New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.

**Grinders, Center.**
Barker & Co., William, Cincinnati, O.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Trump Bros. Machine Co., Wilmington, Del.

**Grinding Machine, Cock.**
Foote, Barker & Co., Cleveland, O.

**Grinding Machine, Cutter.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Foote, Barker & Co., Cleveland, O.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.

**Grinding Machines, Universal.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Landis Bros., Waynesboro, Pa.

**Hack Saws.**
Besly & Co., Chas. H., Chicago, Ill.
Montgomery & Co., New York.
Q. & C. Co., Chicago, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.

**Hammers, Drop.**
Long & Allstatter Co., Hamilton, O.
Miner & Peck Mfg. Co., New Haven, Conn.
Mossberg Mfg. Co., Attleboro, Mass.
Stiles & Fladd Press Co., Watertown, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

**Hammers, Power.**
Bradley Co., The, Syracuse, N. Y.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Hill, Clarke & Co., Boston, Mass.

**Hoists.**
Maris Bros., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

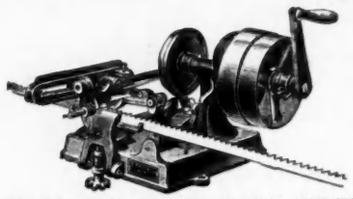
**Hydraulic Machinery.**
The Watson-Stillman Co., New York.

**Indicators.**
Ashcroft Mfg. Co., New York.

**Injectors.**
American Injector Co., Detroit, Mich.
Penberthy Injector Co., Detroit, Mich.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Keyway Cutter.**
Baker Bros., Toledo, O.
Mitts & Merrill, Saginaw, Mich.

(Continued on page 29.)

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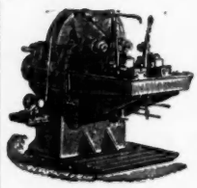

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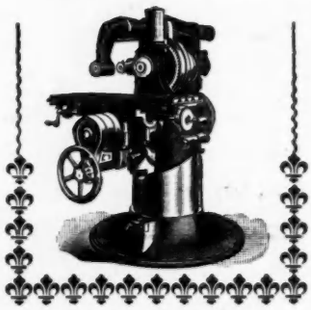

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57 inch x 20 feet Planer.
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Milling Machine.
Cranes, Blower.

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16 in. x 6 ft., Dexter.
16 in. x 8 ft., Blaisdell.
16 in. x 8 ft., Fitchburg.
18 in. x 10 ft., Blaisdell.
18 in. x 10 ft., Flather.
18 in. x 6 ft., Muller.
21 in. x 8 ft., Lodge & Davis.
29 in. x 16 ft., G. A. Ohl.
33 in. x 16 ft., Ames Mfg. Co.
33 in. x 16 ft., New Haven.
34 in. x 20 ft., Perkins.

PLANERS.
6 in. x 16 in. x 3 ft., Pratt & Whitney.
20 in. x 20 in. x 5 ft., Haywards.
22 in. x 22 in. x 5 ft., H. C. Pease.
24 in. x 24 in. x 8 ft., Fitchburg.
26 in. x 26 in. x 6 ft., D. W. Pond.

SHAPERS.
6 in., Boynton & Plummer.
10 in., Wood & Light, traverse.
10 in., Juengst, crank.
15 in., F. E. Chase, crank.
15 in., Lodge & Davis, crank.

DRILL PRESSES.
10 in., Bench, sensitive.
10 in., Slate, 2 spindle.
No. 2 Garvin, 3-spindle.
3-Spindle Hendey.
No. 2 Pratt & Whitney, 4-spindle.
20 in. Quint Turret Drill.
21 in. Prentice B. G. W. F.
25 in. Pond S. H. W. F.
25 in. Barnes B. G. F. F.
Prentice Bros Suspension.
9 ft. Holly Radial.

SCREW MACHINES.
No. 5 Brown & Sharpe.
No. 2 1-2 Pratt & Whitney.
13 in. x 5 ft., Windsor.
16 in. x 5 ft., Warner & Swasey.

MISCELLANEOUS.
No. 1 Slate Automatic Gear Cutter.
No. 1 1-2 P. & W. Hand Miller.
No. 13 Garvin Miller.
1-Spindle Garvin Profiler.
10 in. Diamond Hand Lathes.
12 in. Garvin Hand Lathes.
13 in. x 6 ft. Reid Hand Lathes.
16 in. Square Arbor Fox Lathe.
4 1-2 in. P. & W. Cut-off Machine.

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1 16 in. x 6 ft., Dustin Eng. Lathe.
3 18 in. x 6 ft., L. & D. Eng. Lathe.
1 19 in. x 6 ft., Fifield Eng. Lathe.
1 20 in. x 11 ft., L. & M. Eng. Lathe with Shafting tool rest.
2 21 in. x 10 ft., Pratt & Whitney.
1 23 in. x 10 ft., White Eng. Lathe.
1 27 in. x 10 ft., Dustin Eng. Lathe.
1 27 in. x 12 ft., Wood & Light.
1 28 in. x 12 ft., Wood & Light.
1 28 in. x 16 ft., Eng. Lathe.
1 30 in. Lodge & Shipley, gear blank and pulley tur. and bor.
1 36 in. x 12 ft., Geared Eng., heavy
1 32 in. x 13 ft., B. & D. triple Gd. S. C. comp. rest.
1 40 in. x 16 ft., geared plain turn'g.
1 48 in. x 18 ft., Gay & Silver.

PLANERS.
1 16 in. x 16 in. x 3 ft., Hand.
2 24 in. x 24 in. x 4 ft., Pond.
2 24 in. x 24 in. x 4 ft., W. & L.
1 24 in. x 24 in. x 7 ft., L. & M.
1 28 in. x 28 in. x 5 ft., G. & S.
1 30 in. x 30 in. x 8 ft., S. & S.
1 32 in. x 32 in. x 10 ft., W. & L.
1 32 in. x 10 ft., Open Side.
1 36 in. x 36 in. x 10 ft., New Haven.
1 36 in. x 36 in. x 18 ft., William Sellers.
1 38 in. x 38 in. x 10 ft., Aldrich.
3 48 in. x 32 in. x 6 ft., Pond, with two heads, new pattern.

DRILL PRESSES.
6 Sensitive Bench Drills.
4 Suspension Drills, Pond.
1 10 in. two-spindle Sensitive Drill
1 22 in. back-geared Drill.
1 34 in. back-geared Drill.
1 36 in. Gap Drill, power feed.
1 3-spindle Pratt & Whitney, adj.
2 3-spindle Sensitive, adjble.
1 Quint Turret with tapping attachment, six-spindle.
1 4 ft. arm Radial, Hilles & Jones.

SHAPERS.
1 15 in. Crank.
1 12 in. Traveling Head.
1 9 in. William Sellers, trvg. hd.
1 13 in. Bement & Sons, trvg. hd.
1 12 in. Hewes & Phillips, heavy.

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2 No. 2, Bement & Miles, Hzl.
1 No. 2, Pedrick & Ayer Cyl. Borer.
1 30 in. Stevens Pulley.

SCREW MACHINES.
1 No. 2, Pratt & Whitney, plain.
1 No. 2, P. & W. W. F. Oil Pump
1 No. 3, P. & W., f. c. hd. bk. gd. p. f. to turret slide oil pump.
1 18 in. P. & W., Turret Head Chucking Machine, oil pump.

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1 No. 5, Springfield Water Tool Grinder.
1 No. 2, L. & F. Tool Grinder, two wheels.
1 No. 6, Diamond, surfacing att.
1 No. 3, Universal Cutter Grinder.
1 No. 1, Diamond Univsl. Grinder.
1 Brainard Cutter Grinder, on col.
1 P. & W. Forming Tool Grinder.

POWER PRESSES.
1 No. 95, Bliss Double Pitman.
1 No. 4, C. & M., single action.
1 No. 30, Bliss, single action.

MISCELLANEOUS.
1 2-spindle Profiler; Edging Mach.
1 4 in. H. & R. Cutting-off Mach.
10 Bench Vises, various sizes.
1 48 in. Gear Cutter.
1 No. 1, Warner & Swasey Vertical Miller.
1 C. & C. Electric Motor, 50 K. W. Generator.
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16 in. x 6 ft. Lodge & Barker Square Arbor Fox Lathe.
Style B Full Universal Bickford Radial Drill.
No. 3 Baush Plain Radial Drill.
36 in. New Haven Upright Drill, back gears, power feed.
25 in. Snyder Back Geared and Power Feed Drill.
70 in. x 60 in. x 30 ft. Pond Planer, 2 heads.
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D. W. Pond Index Milling Machine. [and Vises.
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9 in. Bement Slotter, all feeds.
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18 in. x 8 ft., New Haven.
19 in. x 10 ft., Pond.
20 in. x 8 ft., Pond.
20 in. x 15 ft., Pond.
20 in. x 8 ft., New Haven.
20 in. x 10 ft., Harrington.
22 in. x 12 ft., Perkins.
23 in. x 12 ft., New Haven.
24 in. x 12 ft., Putnam.
26 in. x 12 ft., Bogert Triple G'd.
26 in. x 10 ft., Lathe & Morse.
28 in. x 12 ft., Bradford.
38 in. x 18 ft., Fifield.
42 in. x 16 ft., Hewes & Phillips.
52 in. x 16 ft., Hewes & Phillips.
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**DRILLS.**
12 in., Sensitive.
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20 in., " Auto. Feed.
22 in., Snyder, Complete.
24 in., Ames, "
48 in., Heavy Pattern.
Universal Warrens, 5 ft. Arm.

**PLANERS.**
12 in. Stroke, Crank.
16 in. x 4 ft., Hendey.
20 in. x 4 ft., New Haven.
22 in. x 4 ft., New Haven.
22 in. x 5 ft., Pease.
24 in. x 5 1-2 ft., New Haven.
24 in. x 7 ft., Pratt & Whitney.
26 in. x 8 ft., Draper.
30 in. x 6 ft., Pond.
30 in. x 6 ft., Pease.
32 in. x 8 ft., Pond.
36 in. x 12 ft., Pond.
36 in. x 14 ft., Betts.
48 in. x 16 ft., Putnam.
60 in. x 14 ft., Gray.

**SHAPERS.**
14 in. Stroke, Gould & Eber.
16 " Prentiss Crank.
16 " Prentiss Friction.
16 " Latest Crank.
22 " Latest Geared.
24 " Hendey Friction.
14 in. Traveling Head, Fitchburg.
14 " " Warren.
14 " " Pratt & Whitney.

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Lincoln Miller.
Pratt & Whitney Miller No. 2.
No. 2 Screw M'che, Latest.
No. 3 " " P. & W.
No. 4 " " 2 in. Hole.

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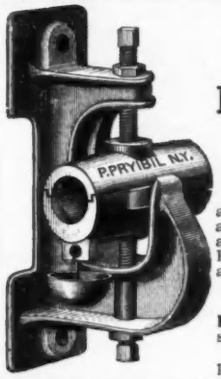


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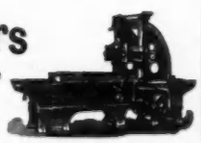

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Blaisdell & Co., P., Worcester, Mass.
Bradford Mill Co., The, Cincinnati, O.
Brown & Sharpe Mfg Co., Providence, R. I.
Bullard Machine Tool Co, Bridgeport, Conn.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dietz, Schumacher & Boye, Cincinnati, O.
Fifield Tool Co., Lowell, Mass.
Fish Machine Works, H. C., Worcester, Mass.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Gould & Eberhardt, Newark, N. J.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
McFadden Co., Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Sebastian Lathe Co., Cincinnati, O.
Sebastian-May Co., Sidney, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Stark, John, Boston, Mass.

**Machinists' Tools and Supplies.**
Machinists' Supply Co., Chicago.
Montgomery & Co., New York.
Sawyer Tool Co., Athol, Mass.
Standard Tool Co., Athol, Mass.
Starrett Co., The L. S., Athol, Mass.

**Milling Attachment.**
Adams Co., The, Dubuque, Iowa.

**Milling Cutters.**
Brown & Sharpe Mfg. Co., Providence, R. I.
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Erlandsen, J., New York.
Garvin Machine Co., New York.
Ingersoll Milling Machine Co., Rockford, Ill.
Reinecker, J. E., Chemnitz-Gablenz, Germany.
Starrett, L. S., Athol, Mass.

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Brainard Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Forbes & Co., W. D., Hoboken, N. J.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Ingersoll Milling Machine Co., Rockford, Ill.
Kempsmith Machine Tool Co., Milwaukee, Wis.
Leland & Faulconer Mfg. Co., Detroit, Mich.
McCabe, J. J., New York.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

**Motors, Electric.**
Dallett & Co., Thos. H., Philadelphia, Pa.
General Electric Co., New York.
Roth Bros. & Co., Chicago, Ill.

**Motors, Water.**
Tuerk Hydraulic Power Co., New York.

**Needle Wire.**
Abbott, Wheelock & Co., Boston, Mass.

**Packing.**
Jenkins Bros., New York.
Johns Mfg. Co., H. W., New York.

**Paints, Fire-proof.**
Johns Mfg. Co., H. W., New York.

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**Pattern Letters.**
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Wells, Heber, New York.

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National Pipe Bending Co., New Haven, Conn.

**Pipe Cutting and Threading Machines.**
Armstrong Mfg. Co., The, Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis, Bridgeport, Conn.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Saunders' Sons, D., Yonkers, N. Y.
Wiley & Russell Mfg. Co., Greenfield, Mass.

(*Continued on page 30.*)

**BUYERS' FINDING LIST—Continued.**

**Planers.**

Betts Machine Co., Wilmington, Del.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O
Detrick & Harvey Machine Co., Baltimore, Md.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Garvin Machine Co., New York.
Gray Co., G. A., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co , New York.
Ohio Machine Tool Co., The, Kenton, O.
Pedrick & Ayer Co., Philadelphia, Pa.
Pratt & Whitney Co , Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Wilson, W. A., Rochester, N. Y.

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Bremer Machine Co , G. J., Kalamazoo, Mich.
Ferracute Machine Co., Bridgeton, N. J.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
Stiles & Fladd Press Co., Watertown, N. Y.
Toledo Machine & Tool Co., The, Toledo, O.

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Long & Allstatter Co., Hamilton, O.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
W. & S. Hydraulic Machinery Works, New York.

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Bignall & Keeler Mfg. Co., Edwardsville, Ill.

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New Process Raw Hide Co., Syracuse, N. Y.

**Reamers.**

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Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Taylor - Rice Engineering Co., Gloucester City, N. J.
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Standard Tool Co., Athol, Mass.
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Wyke & Co., J., East Boston, Mass.

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Goetze, O., New York.

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Rose Polytechnic Institute, Terre Haute, Ind.
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McFadden Co., Philadelphia, Pa.
Worcester Machine Screw Co., Worcester, Mass.

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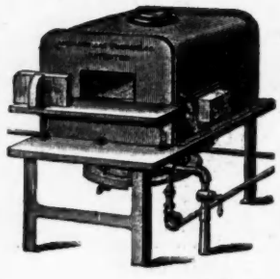
Reece, Edw. J , Greenfield, Mass.
Wells Bros., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

(*Continued on page 31.*)

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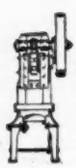

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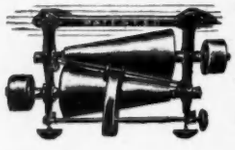

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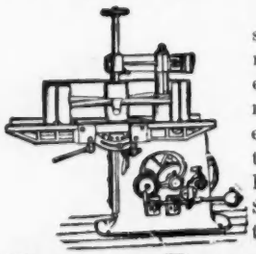

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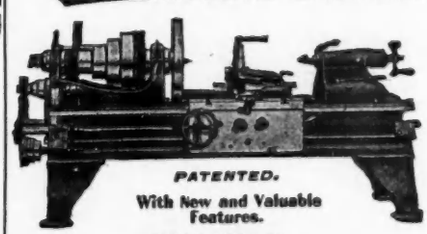

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